CIPEC

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2000/2001 ANNUAL REPORT

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OUR MISSION

To promote effective voluntary action that reduces industrial energy use per unit of production, thereby improving economic performance while participating in meeting Canada's climate change objectives.

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CHAIRMAN'S LETTER

CIPEC

The Honourable Herb Dhaliwal
Minister of Natural Resources Canada
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Dear Minister:

I am honoured to present, once again, the Canadian Industry Program for Energy Conservation's (CIPEC's) *2000/2001 Annual Report.*

I am pleased to report that CIPEC industries continued to make a positive contribution to Canada's efforts to achieve greater energy efficiency and reduced greenhouse gas (GHG) emissions. Between 1990 and 2000, these industries achieved an average annual aggregate energy intensity improvement of 2.4 percent. This represents an energy saving that is equivalent to 95 percent of Canada's residential heating demand in 2000 and contributed significantly to the estimated $1.8 billion in fuel costs saved by Canadian industry through effective energy management in the year 2000.

These energy savings have also had substantial environmental benefits, making a significant contribution to Canada's efforts to meet its international climate change goals. Energy-related GHG emissions have essentially stabilized at 1990 levels for the period 1990–2000. Had there been no energy intensity improvement between 1990 and 2000, Canada's GHG emissions in 2000 would have been 27 percent higher. Once again, CIPEC has demonstrated that voluntary cooperation between business and government can be a powerful ally in Canada's environmental mission.

CIPEC also brings great value to participating industries. The energy savings that companies have achieved through the CIPEC program also represent cost savings – money that translates into improved competitiveness and a healthier bottom line. CIPEC's ability to contribute to business success is the main reason that the organization now encompasses 25 industrial sectors, 43 trade associations and more than 95 percent of Canada's overall industrial energy demand.

CIPEC's efforts to promote "more active companies in the program, and more active programs in the companies" are bearing fruit. Sector conferences and workshops, which provide the tools and information that companies need to launch and reinforce energy efficiency activities, continue to surge in popularity. A further 28 companies joined the Industrial Energy Innovators program since this report was last submitted, bringing the total number of organizations participating in this program to 314. For the first time, we report on the efforts of the upstream oil and gas sector and the electricity generation sector, both of which joined CIPEC in 2001.

As I will shortly be relinquishing my duties with Falconbridge in favour of other pursuits, I will also be stepping down as Chair of CIPEC. I have enjoyed working with the Government of Canada on this unique and vital partnership. I would like to express my appreciation for the new resources you have allocated for the years ahead through the *Government of Canada Action Plan 2000 on Climate Change*. I am certain that with government and industry working together, Canada will continue to make strong progress toward its climate change goals.

W. Warren Holmes
Senior Vice-President, Canadian Mining Operations, Falconbridge Ltd.
Chair, CIPEC Executive Board

HOW CIPEC WORKS

CIPEC is an umbrella organization overseeing a partnership between government and private industry aimed at improving Canada's industrial energy efficiency. CIPEC comprises sectoral task forces, each of which represents companies engaged in similar industrial activities that participate through their trade associations. The Task Force Council, with representatives from each CIPEC sector, provides a common forum for sectors to share ideas and recommend ways to address common needs. Overall direction is provided by an Executive Board made up of private-sector leaders committed to industrial energy efficiency.

CIPEC's extraordinary public-private relationship is successful because it is built not on government regulation, but on trust. In the CIPEC partnership, voluntary change emerges from consensus and joint action built through open and honest communication.

CIPEC continues to be the focal point for industry's response to Canada's climate change efforts. Our role is to promote the evolution of energy efficiency and to identify and reward those who lead the way.

We carry out this mandate in part through a strong communications and awareness program grounded in our twice-monthly *Heads Up CIPEC* newsletter and in regular features in selected trade magazines. *Heads Up CIPEC*, which was first published in 1997 with a circulation of 55, now has more than 2500 subscribers in more than 1300 organizations and boasts a total readership of almost 10 000. Our communications programs celebrate energy efficiency innovations and the industry leaders behind them and provide ideas to improve business and economic benefits through reductions in energy use.

CIPEC also raises awareness of the goals and benefits of improved energy use in other ways. Non-competitive information is exchanged at regular sector task force meetings. The Task Force Council and individual sectors are constantly at work to broaden participation and to bolster public and industry awareness of the role and achievements of CIPEC industries.

CIPEC volunteers include successful business leaders and others recognized on the national stage. The quality and profile of these leaders and their strong belief in voluntary action without government regulation give CIPEC a strong edge in attracting new industry participants and in continuing the successful partnership between industry and government.

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A UNIQUE VOLUNTARY PARTNERSHIP

The Canadian Industry Program for Energy Conservation (CIPEC) continued to extend its remarkable partnership between business and government during 2000. Canadian industrial establishments turned to CIPEC in record numbers for leadership, guidance and support in their efforts to manage energy more efficiently.

CIPEC remains a unique example of what can be accomplished through voluntary cooperation when public- and private-sector interests converge. The program's unrivalled track record has set the standard for organizations of its type throughout the world.

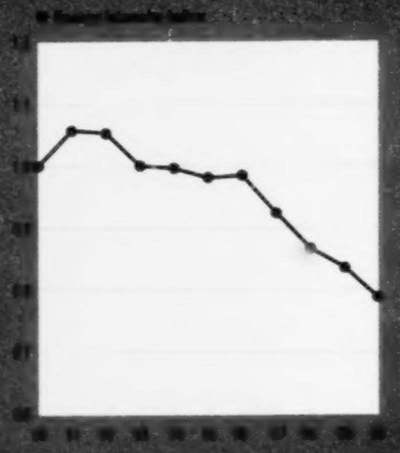
Here are a few of the organization's most significant achievements:

- Companies under the CIPEC umbrella achieved an energy intensity improvement of 2.4 percent per year between 1990 and 2000, well above the 1-percent-per-annum improvement commitment made in 1994. The total energy saved by CIPEC industries during 2000 is equivalent to 95 percent of Canada's residential heating demand in 2000, and it contributed significantly to the estimated $1.8 billion in fuel costs saved by Canadian industry through effective energy management in the year 2000.
- Effective energy management by CIPEC industries has contributed to a healthier environment. While energy-related GHG emissions were up 1.7 percent in 2000, CIPEC industries outperformed other sectors of the economy during the year. In fact, without the strong energy intensity improvements made by companies involved with CIPEC, industrial emissions for the decade would have been 27 percent higher.
- Five new trade associations signed letters of cooperation with CIPEC, bringing total participation to 43 associations. Collectively, these groups represent more than 95 percent of secondary industrial energy demand. Significantly, three of these associations represent energy suppliers, including the Canadian Association of Petroleum Producers, the Small Explorers and Producers Association of Canada and the Canadian Electricity Association.
- There are now 25 CIPEC task forces, as CIPEC has extended its scope beyond mining and manufacturing to include a wider spectrum of Canadian industry.
- By the end of 2001, 314 companies had become Industrial Energy Innovators, an increase of 28 companies from the previous year. The continuing willingness of Canadian companies to become Industrial Energy Innovators points to the direct relationship between sound energy management and business success.

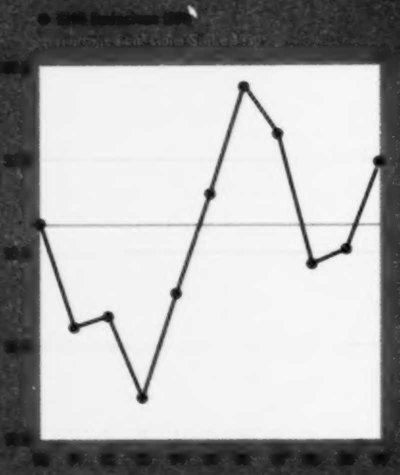
THE EVOLUTION OF CIPEC DATA

Accurate measurement and meaningful data are fundamental to measuring energy efficiency improvements. The data used in this report are collected by Statistics Canada and interpreted by the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) at Simon Fraser University in Burnaby, British Columbia. From Statistics Canada data, CIEEDAC produces energy intensity indicators for each sector based on production and GDP. CIPEC continues to collaborate with Statistics Canada and CIEEDAC in ongoing efforts to ensure measurement accuracy and acceptability.

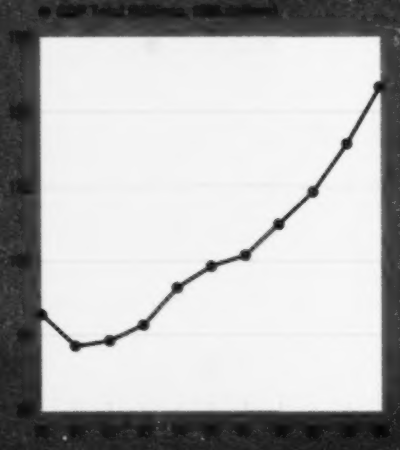
The cooperative CIEEDAC system is internationally recognized for its methodologies, data integrity and cooperation with CIPEC. Primary funding for CIEEDAC comes from Natural Resources Canada, with additional contributions from industry associations that participate in CIPEC and the province of Quebec.



CIPEC Aggregate Energy Intensity Index 1990–2000
Base Year 1990 (1.00)



CIPEC Aggregate Energy-Based Greenhouse Gas
Emissions (No Electricity Emissions) 1990–2000



CIPEC Economic Growth: Aggregate GDP
(billions, 1986 dollars) 1990–2000

- According to Natural Resources Canada's (NRCan's) statistics, while energy use by CIPEC industries increased 13 percent between 1990 and 2000, their gross domestic product (GDP) rose by 44 percent. This points to a significant reduction in energy intensity across Canada's entire spectrum of industry. Simply put, it takes a lot less energy today to produce a dollar value of product than it did at the beginning of the 1990s.

Industry has embraced CIPEC because of a growing realization that what is good for the environment can also be good for business. Sector by sector and company by company, manufacturing and mining companies are making intelligent, voluntary energy management decisions to adopt energy-saving technology and efficient new processes. Across the nation, these decisions are helping participating businesses to cut costs and increase profits. Combined on a national scale, these actions are reducing Canada's energy consumption and GHG emissions and helping the country to meet its international climate change goals.

GROWING SUCCESS FOR CIPEC

CIPEC's current three-year mandate is to promote "more active companies in the program, and more active programs in the companies." Efforts toward this goal are paying off. CIPEC's growth continued unabated in 2000, and participation in the program is at an all-time high.

To bring new, active companies into the energy efficiency fold, CIPEC added new sector task forces that cover electricity generation, construction and upstream oil and gas and will seek to further extend its reach. CIPEC can now be considered the energy efficiency focal point for all of Canadian industry.

Efforts to encourage more active programs in Industrial Energy Innovator companies have been equally fruitful. Attendance at CIPEC-sponsored energy conferences is surging, and company representatives attending these events are applying what they learn to improve the energy efficiency of their organizations. Moreover, in conjunction with NRCan's Office of Energy Efficiency, workshops are now available to individual companies for presentation to operations and maintenance personnel at company facilities, thereby extending energy efficiency initiatives to the shop floor.

Individual companies are employing ingenious concepts to further energy efficiency. For example, DuPont Canada Inc. has adopted an innovative financing method that takes energy efficiency investments off the balance sheet and pays for capital improvements with the savings they generate. With energy investment capital being difficult to find for many companies, innovative financing strategies offer an opportunity to gain the benefits of energy efficiency without taxing what may be limited financial resources.

GROWING EXCELLENCE

Many companies active in CIPEC sectors achieved energy efficiency excellence in 2000/2001. Twelve such companies are highlighted in the "Success Stories" section of this report. In addition, 30 companies have been awarded Champion Reporter status by Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) during the past year. Overall, 65 Industrial Energy Innovator companies have earned Champion Reporter status with VCR Inc.

The excellence of the CIPEC concept and its ability to instigate positive change was affirmed when India chose the CIPEC model as the basis for the Indian Industrial Programme for Energy Conservation (IIPEC). The initiative is part of the India Facilitation of Private Sector Development Project, a joint effort of the governments of India and Canada. The Federation of Indian Chambers of Commerce and Industry and the Indian Ministry of Power are working together to implement the initiative. Following CIPEC's lead, IIPEC will establish a series of energy management sector task forces, made up of representatives from various industries. Initial IIPEC task forces will include cement, pulp and paper, and textiles. Representatives of the Indian program toured Canada and the facilities of CIPEC partners in April 2002.

NEW LEADERSHIP

After 20 years with the CIPEC program and 16 years as Chair of the Task Force Council, W. Peter Torbet has decided to step down. CIPEC has grown dramatically on Peter's watch, and his contribution to the organization's success is beyond measure.

Replacing Peter as Chair is Susan Olynyk. Sue, a Senior Energy Specialist with Dofasco Inc., has been a Task Force Council member and active CIPEC participant for more than eight years.

NEW FUNDING AND NEW TOOLS

In November 2001, the Government of Canada bolstered its commitment to address climate change by announcing 28 specific actions designed to cut Canada's GHG emissions by more than 23.7 megatonnes by 2010. The projects are part of the Government of Canada's $1.1-billion commitment to action on climate change announced in its 2000 budget.

CIPEC's growing success in fostering industrial energy efficiency has led the Government of Canada to earmark substantial funding for practical tools and initiatives that support the efforts of companies under the CIPEC umbrella. These programs include support for the following:

- Improved tracking and reporting of energy efficiency and emissions trends to encourage industry to pursue climate-change-related activities and help the Government of Canada to identify promising emissions-reduction opportunities.

- Emissions benchmarking studies to help companies to assess their energy efficiency and GHG-emissions performance relative to comparable operations.

- Energy efficiency audits to provide financial assistance and guidance to Industrial Energy Innovator companies that are conducting on-site audits to identify energy efficiency opportunities.

- Awareness building to provide tools such as customized energy management workshops, technical support, guidebooks and videos to small- and medium-sized enterprises to expand awareness of the benefits of reducing GHG emissions.

In addition, CIPEC was allocated additional funding to enable it to add the electricity generation, construction, forestry, and upstream oil and gas sectors to its list of participating industries. The Government of Canada's announcement also included funding for innovation in GHG-reduction and carbon dioxide (CO_2) storage technologies, support for programs that promote GHG credits, and the development of ethanol fuels from biomass.

These programs and their associated investments will help Canadian industry build on the momentum toward energy efficiency it has already established. CIPEC is proud of its contribution to this effort.

SUSTAINING CIPEC'S MOMENTUM

CIPEC's mission remains the same: to promote, encourage and foster energy efficiency improvements and GHG-emissions reductions through voluntary action throughout Canada's industrial sectors. With the vast majority of Canadian industry now covered by the CIPEC umbrella, efforts to deepen the commitment by individual companies to increased energy efficiency are vital to sustaining CIPEC's momentum.

The task is a challenging one. Operations that are seeking to invest in new energy-related technologies must compete for limited funds with other corporate activities, and CIPEC must continue to provide programs that support their efforts to demonstrate that these technologies will bring adequate returns as well as environmental benefits. CIPEC's relevance has been built on its ability to offer innovative, cost-effective energy management concepts and to demonstrate effectively the relationship between energy efficiency and business success.

Although the task is formidable, CIPEC has proven over more than 25 years that it is up to the challenge. The enthusiasm, dedication and commitment demonstrated on both sides of this unique private- and public-sector partnership has enabled the program to overcome many obstacles in the past. Going forward, the additional funding, new initiatives and expanded sector participation announced in 2001 prepares the program for the demands of the future. These tools ensure that CIPEC is, and will continue to be, a strong and vital contributor to Canada's efforts to meet its international climate change goals.

INNOVATION AND CANADA'S CLIMATE CHANGE VOLUNTARY CHALLENGE AND REGISTRY INC. (VCR INC.)

The Industrial Energy Innovators program helps companies put sector-level commitments into action at the individual corporate level. At the time this report was being written, 314 companies representing approximately 85 percent of industrial energy use in Canada had signed on as Industrial Energy Innovators. Most of these companies are participants in VCR Inc., a non-profit partnership between industry and government across Canada. VCR Inc. provides the means for promoting, assessing and recognizing the effectiveness of the voluntary approach in addressing climate change.

CIPEC has strengthened the participation of Industrial Energy Innovators in VCR Inc. through a number of programs. These include programs to increase awareness of the economic benefits of improved energy use and tools to remove barriers that hinder energy management improvement projects within companies. CIPEC believes that parallel efforts among like-minded organizations are needed to maximize Canada's industrial energy efficiency.

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CIPEC

Canadian Industry Program for
ENERGY CONSERVATION

2000/2001 SUCCESS STORIES

A Record of Achievement

Interest in further improving energy efficiency is thriving as manufacturing and mining companies increasingly recognize the direct relationship between energy efficiency and operating results. Initiatives from nearly every industrial sector across the land are improving energy efficiency, cutting GHG emissions, and helping Canada to meet its international climate change commitments.

In this section, we highlight the recent efforts of 12 companies that have made energy efficiency a key component of their strategic thinking – and a way of life in their operations. Their achievements are representative of the hundreds of success stories that are emerging within the CIPEC family. We present these stories in the hope that they will inspire others to advance energy efficiency programs within their organizations.

After all, it is only through the willingness of individual enterprises to embrace innovation and to adopt new methods and technologies that CIPEC will remain a shining example of voluntary, cross-sectoral co-operation. Through such innovation, the industrial sector will continue to do its part to help Canada achieve its objectives as set out in the Kyoto Protocol.

ALCAN INC.

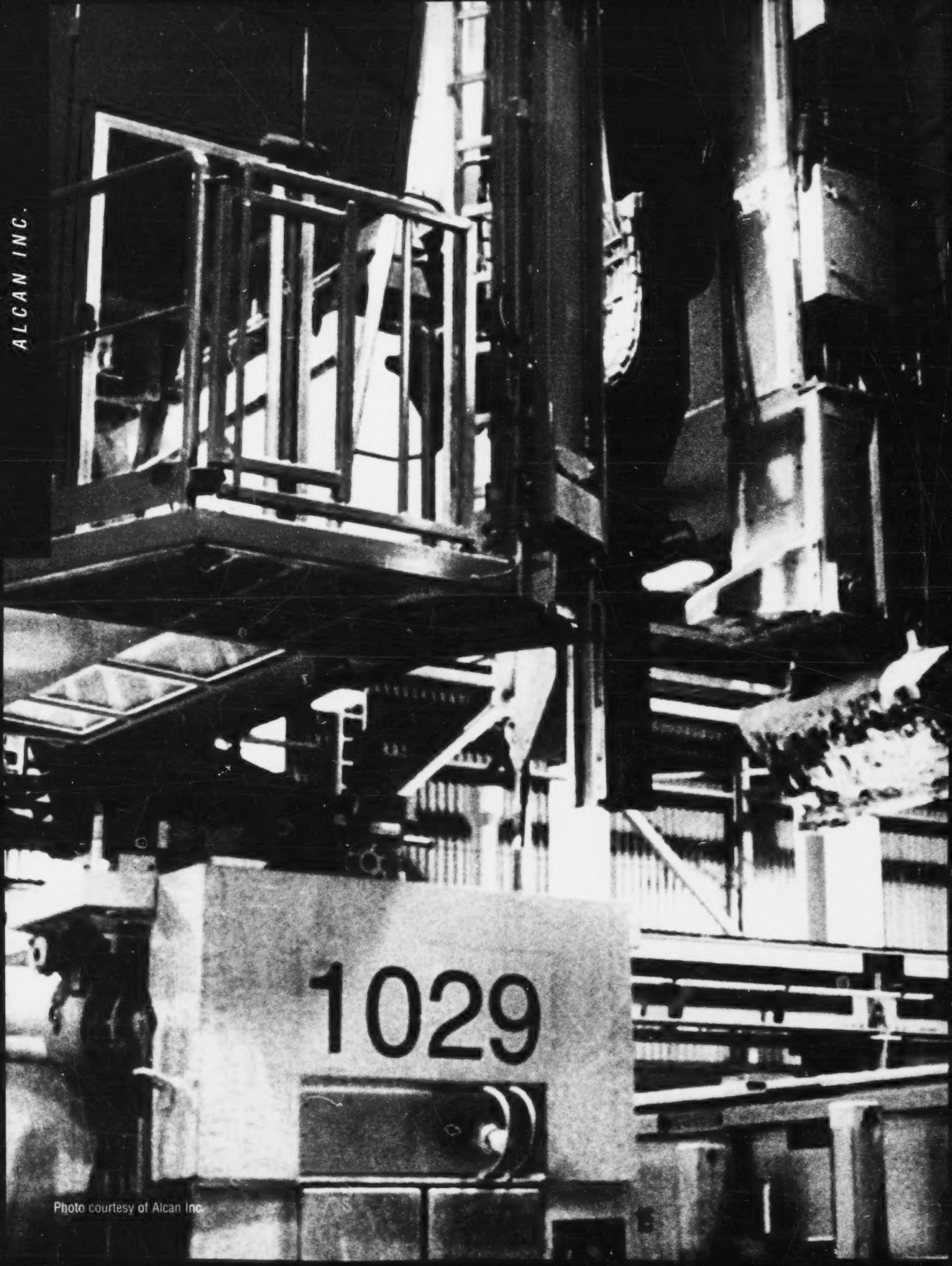


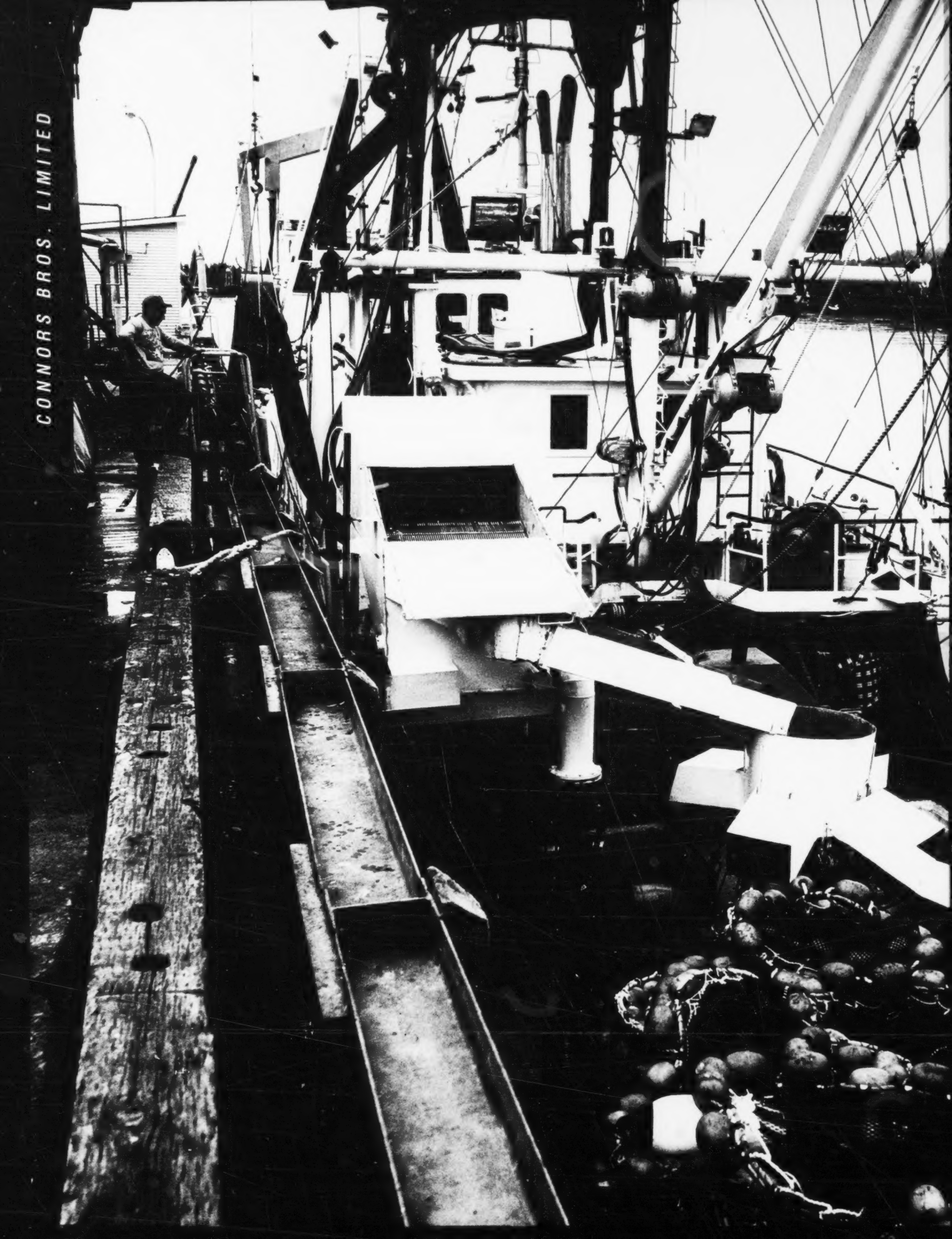
Photo courtesy of Alcan Inc.

Alcan Inc. on Target to **Reduce GHG Emissions** at State-of-the-Art Facility

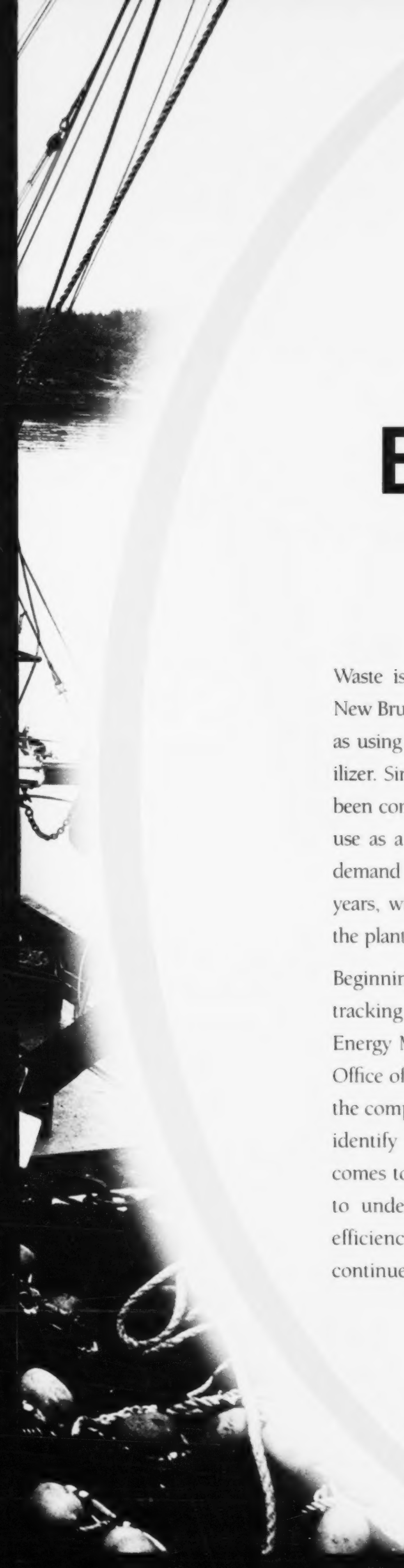
Alcan's new $1.6-billion smelter in Alma, Quebec, is the company's first expansion in primary-metals production in two decades and marks the culmination of a rebuilding program begun in the late 1980s. On schedule to be at full production in the third quarter of 2001, the 400 000-tonne Alma smelter, which incorporates the latest energy efficiency technologies, will replace the company's nearby 75 000-tonne facility in Isle-Maligne, Quebec.

The massive plant will require 620 megawatts of power to operate, all of which will be provided by hydro-electricity. Half of the power will come from Alcan's own hydro-electric grid, with the balance provided by Hydro-Québec. Using hydro-electricity will enable the plant to emit only 15 percent of the greenhouse gases (GHGs) produced by typical smelters around the world that use fossil fuel-generated power.

In recent years, Alcan has devoted considerable effort to identify sources of GHG emissions throughout its operations. This has enabled the company to modify practices and introduce new, high-performance technologies at its smelters. The Alma facility carries on this tradition. In fact, by incorporating technologies that enable better control of anode effects, the Alma plant will emit only one tenth of the polyfluorocarbons produced at the Isle-Maligne facility. There is little doubt that the state-of-the-art Alma facility, in addition to the company's recently adopted TARGET program, will enable Alcan to take a giant stride toward its goal of reducing its GHG emissions.



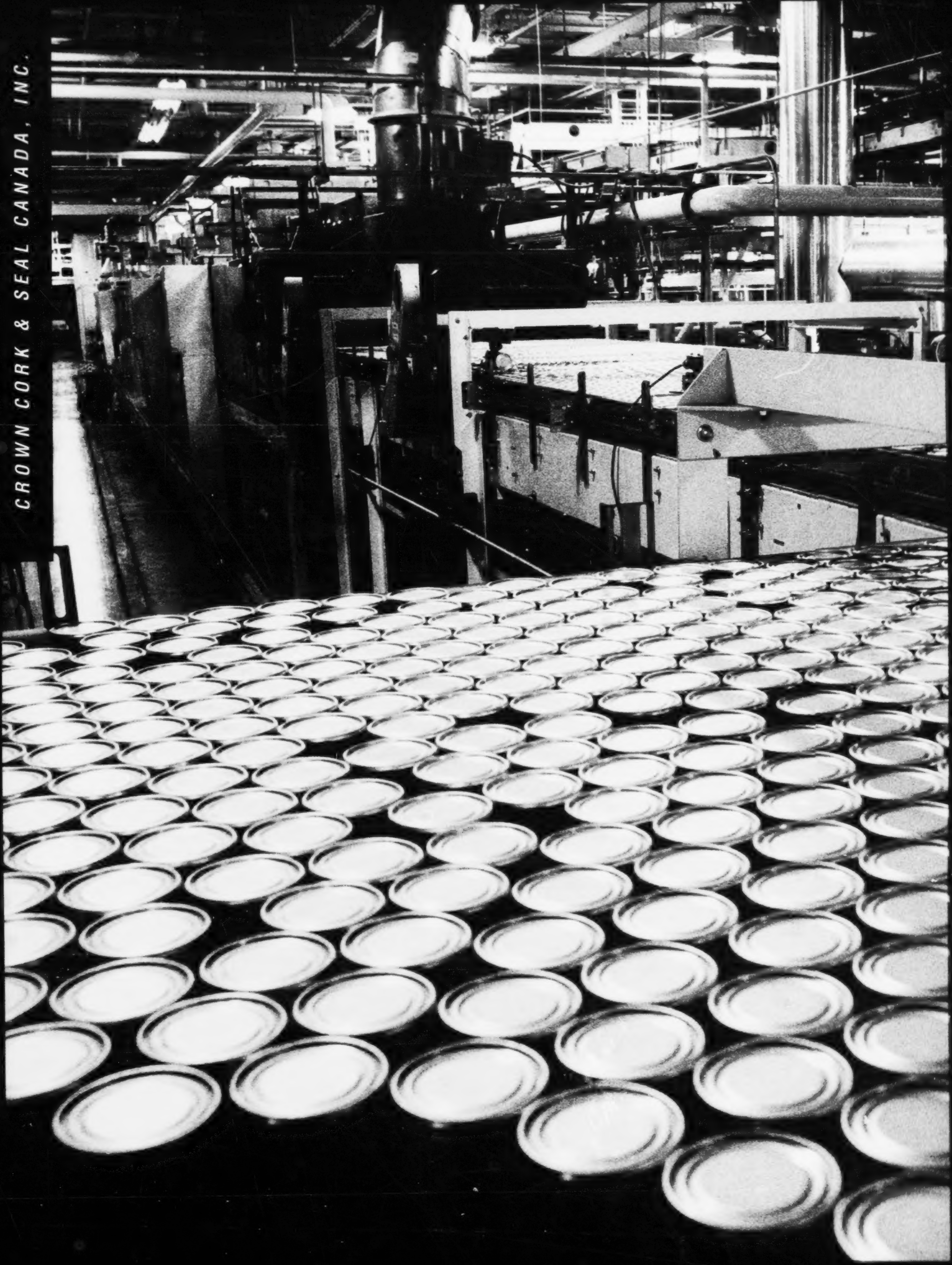
CONNORS BROS. LIMITED



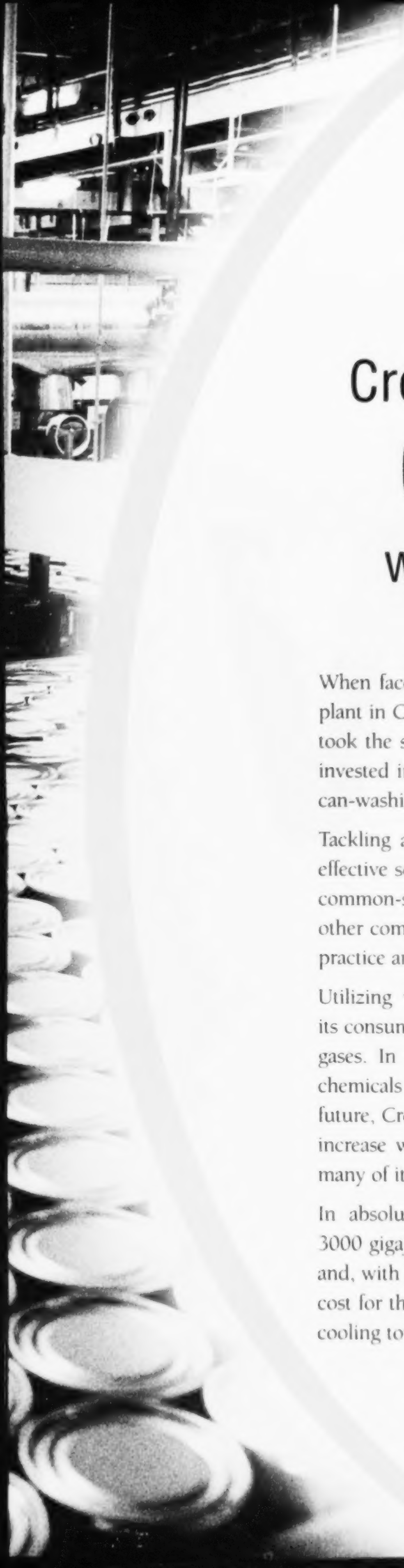
Riding the Wave of **Energy Efficiency at** Connors Bros. Limited

Waste is a four-letter word at **Connors Bros.** The sardine cannery in Blacks Harbour, New Brunswick, has made reducing waste of all kinds a company-wide mandate, going so far as using once-discarded process by-products to create valuable fish meal, fish oil and fertilizer. Since it installed its first power factor controllers in the mid-1970s, the company has been committed to energy efficiency. For example, the company now pumps in seawater to use as a coolant in the plant's air-conditioning system, thereby dramatically reducing the demand for fresh water. A lighting retrofit program has been underway over the past three years, with T-8 fluorescent lamps and compact fluorescents installed in areas throughout the plant.

Beginning in 2000, Connors Bros. initiated improvements to its energy monitoring and tracking system. To further these efforts, the company participated in a "Dollars to $ense: Energy Monitoring and Tracking" workshop offered through Natural Resources Canada's Office of Energy Efficiency. Meters have been installed at key points in the plant, enabling the company to use monitoring and tracking software to spot energy usage anomalies and identify waste instantly, thereby enabling swift corrective action to be taken. When it comes to energy efficiency, Connors Bros. believes that no project is too big or too small to undertake. From using PLC-equivalent microprocessors to improving air-exhaust efficiency, to upgrading with power-saving high-efficiency motors, the company continues to reduce waste wherever it is found.



CROWN CORK & SEAL CANADA, INC.



Crown Cork & Seal Canada, Inc.
Cans Waste Heat
with Common-Sense Solution

When faced with the challenge of removing excess heat from the air compressor at its plant in Calgary, Alberta, **Crown Cork & Seal Canada** didn't take the easy way out – it took the smart approach. Rather than install an additional cooling tower, the company invested in a heat exchanger to capture waste heat and used it to preheat water for the can-washing step in its production process.

Tackling a relatively simple problem with some imagination resulted in a simple but effective solution. Although most industries practice waste-heat utilization, applying this common-sense innovation has improved Crown Cork & Seal's washer operation. Many other companies that use water-cooled compressors or equipment could adopt the same practice and improve their bottom line.

Utilizing waste heat decreased the company's boiler requirements, thereby reducing its consumption of natural gas by 5 percent and decreasing its production of greenhouse gases. In addition to its straight gas savings, the plant has been able to reduce the chemicals used in its washer and has made minor savings in water consumption. In the future, Crown Cork & Seal hopes to use more of the waste heat from the compressor to increase washer water temperature. The company plans to implement this practice at many of its operations worldwide to achieve the same benefits.

In absolute terms, the project has reduced the plant's energy use by more than 3000 gigajoules per year. The cost of natural gas saved is slightly over $12,000 per year and, with gas prices expected to increase, the value of this project can only improve. The cost for the readily available commercial unit used for this project was $6,500. A typical cooling tower would have cost more than $25,000.

DAIMLERCHRYSLER CANADA INC.

Photo courtesy of DaimlerChrysler Canada Inc.

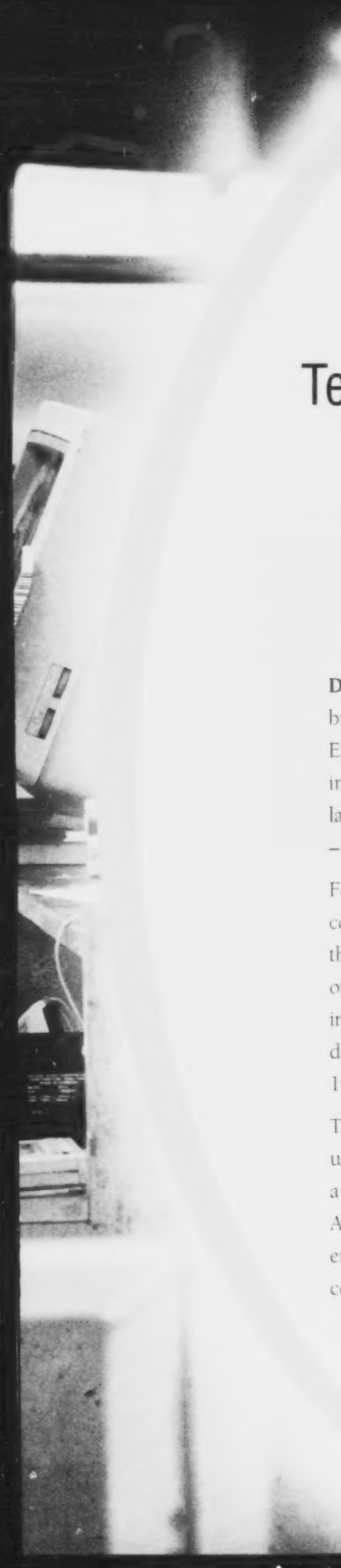
DaimlerChrysler Canada Inc. **Picks up Speed** on Road to Energy Efficiency

DaimlerChrysler Canada has an impressive track record in energy conservation. From 1990 through 1999, by focusing on energy efficiency throughout its manufacturing operations, DaimlerChrysler Canada reduced the energy consumed per vehicle produced by 42.2 percent, from 12.36 MMBtu to 7.15 MMBtu. This improvement represents a reduction in greenhouse gas (GHG) emissions per vehicle manufactured from 0.647 to 0.373 tonne of carbon dioxide equivalent (CO_2e) over the same period.

Thanks to its ongoing emphasis on energy efficiency, DaimlerChrysler Canada anticipates a 1-percent-per-year decrease in energy intensity per vehicle produced from 1999 through 2005. This target represents a reduction in energy use per vehicle produced of 45.5 percent over the period 1990–2005, leading to decreased GHG emissions per vehicle of 0.30 tonne of CO_2e.

To maintain its energy efficiency momentum, DaimlerChrysler Canada is conducting educational activities with employees and unions. To support these and other environmental initiatives, the company is working toward certifying each of its Canadian facilities to ISO 14001 status by the end of 2001. This is a powerful message that signals DaimlerChrysler Canada's commitment to environmental stewardship and its willingness to back up that commitment with action.

DUPONT CANADA INC.



Teamwork Leads DuPont Canada Inc. **to Score on Energy** Reduction Goals

DuPont Canada has successfully merged energy and environmental goals with its business objectives. More than 25 years ago, the company established its Manufacturing Energy Management Team (MEMT), an interdepartmental group that focused on improving energy efficiency throughout the company's Canadian operations. Thanks largely to MEMT's leadership, DuPont Canada consistently achieves – and often exceeds – its energy goals.

For example, a new high-temperature, heat-transfer fluid vaporizer installed at the company's plant in Kingston, Ontario, has a heat efficiency that is 20 percent greater than the equipment it replaced, resulting in savings of 20.4 terajoules per year. Because of this and other energy efficiency projects, MEMT achieved its 10-year goal of a 25-percent reduction in per-unit energy consumption – six years ahead of schedule. Since 1993, the team has documented more than $20 million in cost reductions for DuPont Canada, and between the 1990 baseline year and 1999, it drove total energy consumption reductions of 28 percent.

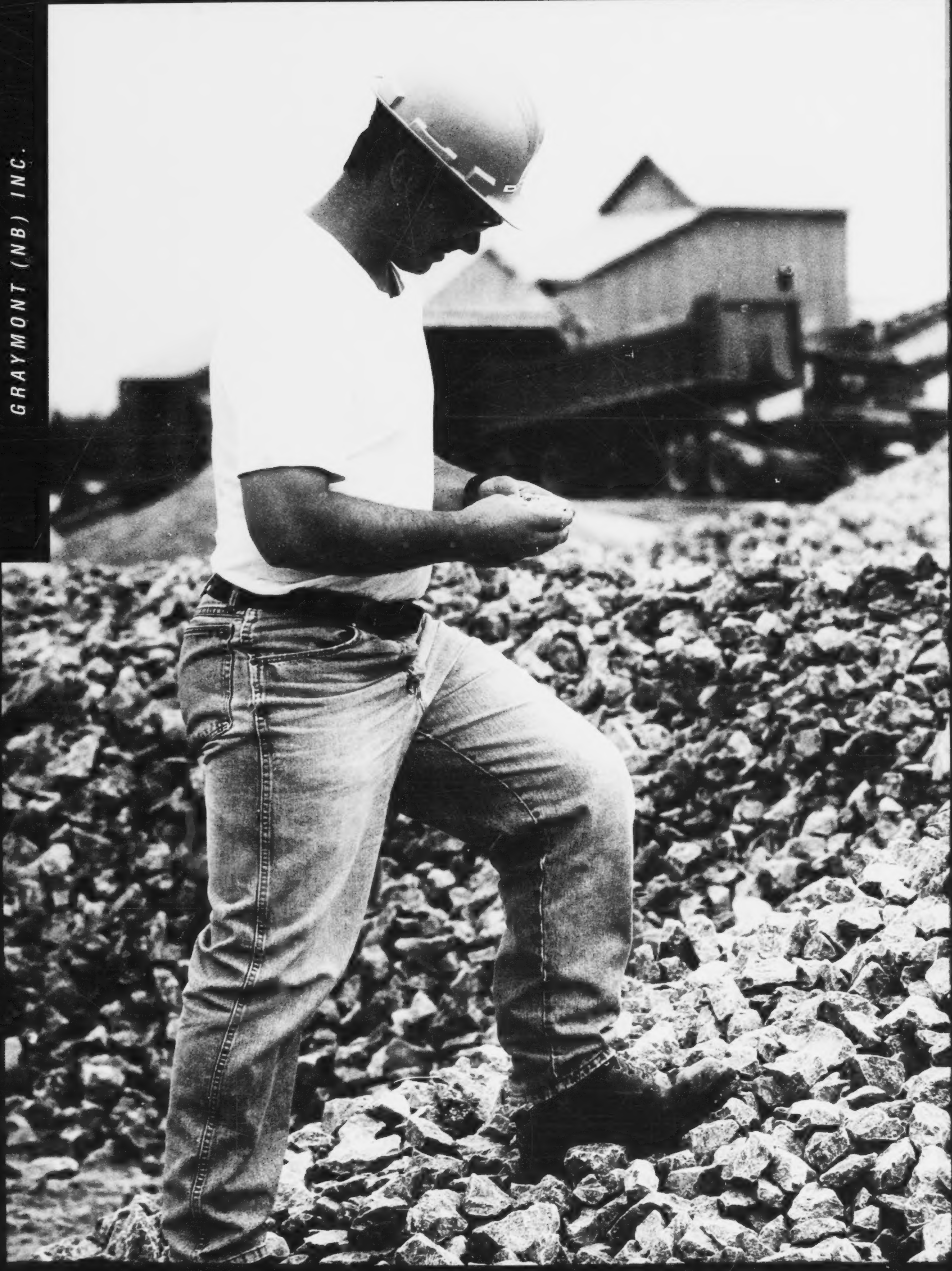
The team's contribution to DuPont Canada's business performance has not gone unnoticed. Peter Chantraine, a tireless advocate of energy efficiency, chair of MEMT and a key member of CIPEC, was awarded DuPont Canada's highest honour, the Daedalus Award. His leadership and ability to see the big picture in the company's energy and environmental management has helped make DuPont Canada a leader in energy conservation and climate change.

FOOTHILLS CREAMERY LTD.

Foothills Creamery Ltd.
Churns Energy Savings
from Lighting Retrofit

Foothills Creamery has taken an activist approach to energy efficiency. The Alberta dairy manufacturer began serious energy-reduction efforts in 1998, when it retrofitted its Edmonton warehouse with new, high-efficiency lighting. The company replaced its existing 60-cm x 120-cm (2-ft. x 4-ft.) fixtures with T-8 lamps and reflectors that use PCB-free single electronic ballasts. Drawing only 58 watts, the new fixtures save 67 percent on the electricity used by each light. Foothills also replaced 240-cm (8-ft.) strip fixtures with a 90-cm x 120-cm (3-ft. x 4-ft.) lamp system with industrial reflectors that use 40 percent less energy and installed energy-saving motion sensors in key areas of the warehouse. The company's $20,000 investment in the retrofit has led to better lighting throughout the facility, reduced labour costs and realized significant savings in electricity usage.

Encouraged by the results, Foothills Creamery agreed to participate in the Alberta Food Processors' Association's "Leading the Way in Canada" pilot project. This project aims to reduce energy consumption and greenhouse gas (GHG) emissions at participating companies by 25 percent. Through energy audits, "Leading the Way in Canada" has identified potential annual energy savings of $6 million and related GHG-emissions reductions of 76 000 tonnes. For Foothills Creamery, energy savings from this project are another step forward on the road to better business performance.



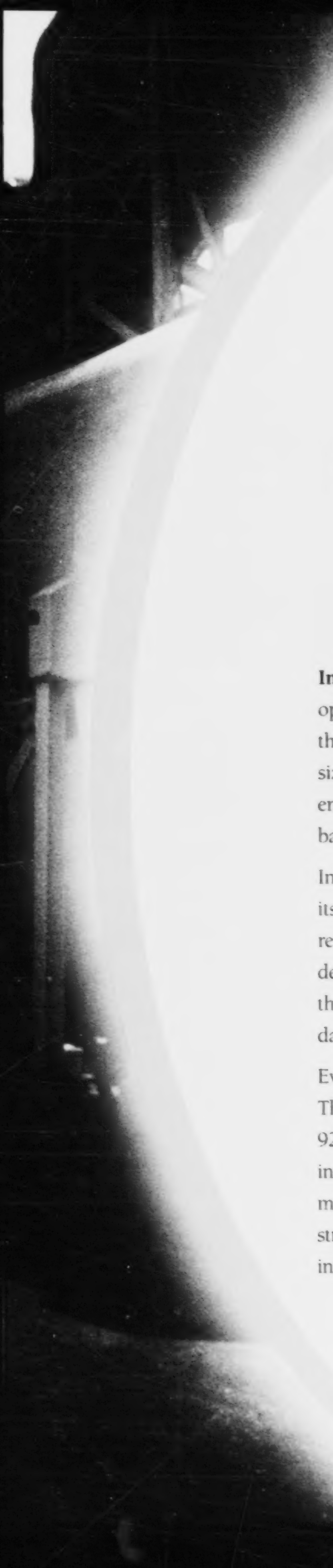
GRAYMONT (NB) INC.

Best-Management Practices Pay off **in Energy Efficiency** at Graymont (NB) Inc.

For Graymont (NB), finding ways to reduce its energy consumption is a key corporate mission. In 1995 the New Brunswick lime producer installed a variable frequency drive on its 300-hp lime kiln exhaust fan. With the fan operating around the clock, the company's $50,000 investment has reduced electricity consumption by 8 percent and netted annual savings of 558 000 kWh. Impressed with the results, the company installed more variable drives, yielding additional savings.

Further energy savings emerged as a by-product of changes made in the crushing and screening process. These improvements increased the yield of kiln feed stone by 5 percent, reduced the quarrying period by two weeks over a seven-month period, and led to significant reductions in the use of electricity and fuel-powered mobile equipment.

In 1996 Graymont (NB) established an energy committee that was later replaced by an Environmental Management System designed on the ISO 14000 model. This system has been instrumental in identifying numerous opportunities to reduce energy consumption. Through these and other initiatives, Graymont (NB) has reduced the energy needed in the kiln process from 105.8 litres of oil per tonne of product to 99.6 litres, leading to a total annual saving of 440 000 litres of oil. These reductions are a clear indication that the company's application of cost-effective, best-management practices to advance environmental protection is delivering results.



Inco Limited Mines Savings with **Energy Breakthrough** System

Inco takes its leadership in the mining sector seriously. A mine-development and operating company with more than 10 000 employees and offices in 15 countries around the world, the company is a global leader in metal extraction and supply. Despite its size, operational diversity and international scope, the company has eagerly placed environment, health and safety among its highest corporate priorities and has annually backed its commitment by establishing aggressive energy action plans for its operations.

In 1999, to extend the scope and reach of its energy efficiency efforts, Inco introduced its Energy Breakthrough (EB) system. EB recognizes that energy management and reductions in greenhouse gas emissions require a system-wide approach with direct, defined responsibilities at each level of management. With Inco's commitment to targets that are among the most aggressive in Canadian industry, EB provides the necessary foundation for company-wide action.

Even before EB was introduced, Inco's energy efficiency efforts delivered results. The company's absolute emissions decreased from 939 kilotonnes of CO$_2$e in 1998 to 926 kilotonnes in 1999, despite a temporary, short-term increase in its energy and emissions indices. Moreover, Inco reduced its 1999 energy index by 9 percent relative to 1990, fully meeting the company's target of a 1-percent annual improvement. EB, with its formal structure and aggressive targets, should enable Inco to build on these improvements long into the future.

LAKE ERIE STEEL COMPANY

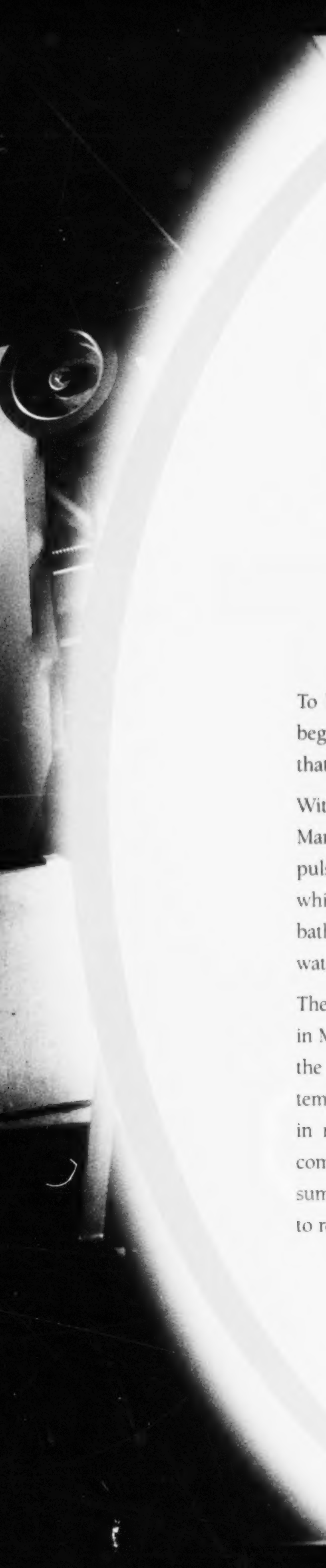
Lake Erie Steel Company
Blasts Energy Costs
with Innovative Project

Innovative thinking at **Lake Erie Steel Company** is yielding big energy savings. The company is using steam that is produced by waste blast-furnace gas to power air compressors in the cryogenic air-separation plant at its smelter in Nanticoke, Ontario. Lake Erie Steel located the new plant between its boiler house and cooling towers, enabling it to make better use of the steam generation and distribution system already in place, reduce connection costs and utilize its existing capacity to turn blast-furnace gas into steam. To make the process work, the company invested in a new steam turbine, auxiliary equipment and an enlarged cooling plant.

This project demonstrates that wherever a process that produces high-grade waste heat requires oxygen or nitrogen, recovered energy can be used to drive the generation of the gases. This can be applied not only in smelting, but also in steel basic-oxygen furnaces, pulp and paper mills, textiles and chemical manufacturing.

As a result of this project, Lake Erie Steel is using a no-cost, previously wasted energy source to replace purchased energy. The results are impressive. The company has reduced its energy usage by 192 terajoules per year and is saving about $1.7 million in annual operating costs. Moreover, the company has increased its blast furnace's productivity by 25 percent and has significantly reduced its NO_x and carbon dioxide emissions by 91 tonnes and 47 000 tonnes per year respectively.

MANOIR



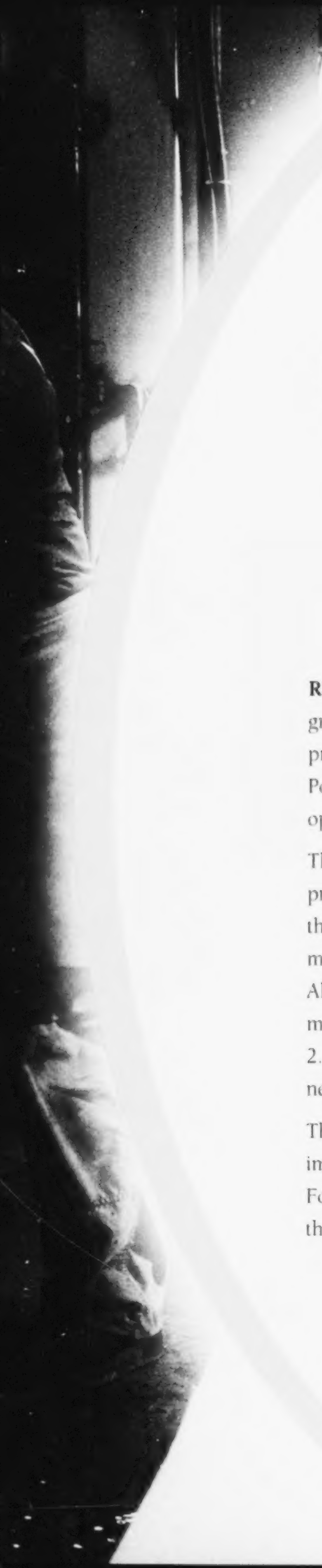
Manoir Inc.
Throws Cold Water
on Rising Energy Costs

To become a leader in the textile industry, **Manoir,** located in Saint-Laurent, Quebec, began from scratch. In 1994 the company built a dye house to contain new equipment that produces superior-quality fabric while reducing water and energy consumption.

With the dyeing process consuming three times as much water as the bleaching process, Manoir came up with two solutions to reduce its water use – a cool-rinse process and a pulsating rinse. The cool-rinse process allows for simultaneous rinsing and cooling, which reduces cycle times and energy consumption. The pulsating rinse dilutes the dye bath gradually while the machine is operating. This process uses 20 to 30 percent less water and takes less time.

The recently installed central heat recovery and exchange system is another key component in Manoir's energy efficiency program. The main aspect of the system is that drainage from the dye machine, when passed through the coiled heat-exchange station, exits at a cooler temperature. The cooling water used in the process is thus heated and stored for later use in reservoir tanks. This system ensures a virtually constant supply of water at 52°C, compared to municipal water temperatures of close to 0°C in winter and up to 7°C in summer. This not only affords considerable savings in energy but also enables Manoir to respect effluent temperature requirements.

UNI-
COR
Riverside
FOREST PRODUCTS LIMITED
SPF



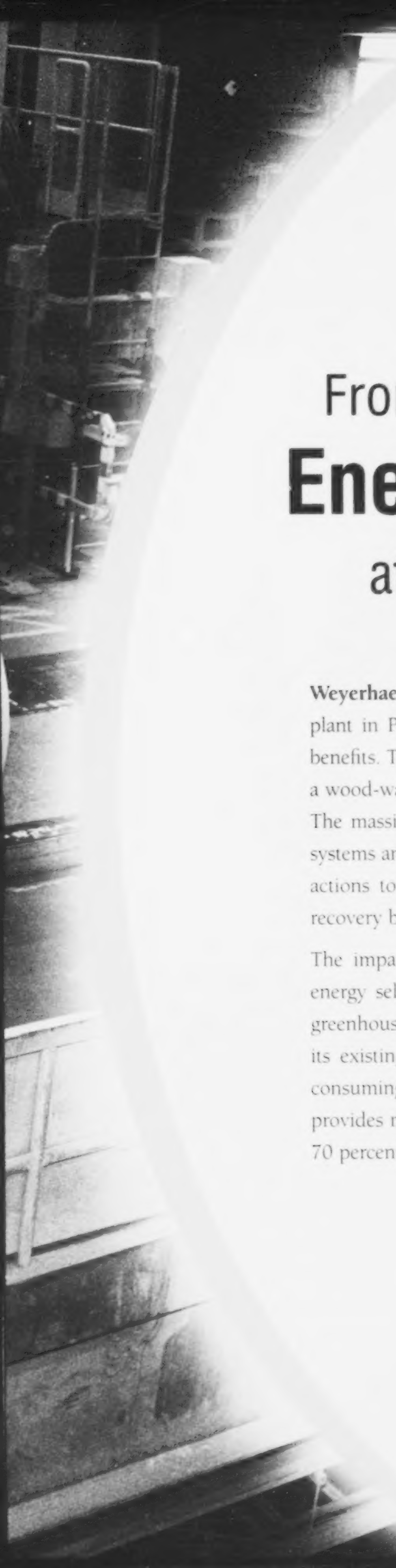
Riverside Forest Products Limited **Cuts Electricity** Consumption

Riverside Forest Products is serious about its commitment to significantly reduce its greenhouse gas emissions through energy conservation. An energy performance pilot project at its plywood plant in Armstrong, British Columbia, was co-funded by BC Hydro's Power Smart Services Program. This pilot study sought to assess potential energy savings opportunities in a typical wood-products manufacturing plant.

The study focused on power factor correction, veneer-drying systems and the plant's pneumatic conveying systems (fan-driven systems that move materials). It was discovered that motors in these systems were operating at low efficiency (from 27 to 50 percent), many fans were inefficient and air pressures in some systems were higher than necessary. All of these factors wasted energy and added to the plant's operating costs. A series of modifications will reduce the plant's annual electricity consumption by more than 2.1 GWh and generate annual savings of $98,200. With an investment of $326,000 needed to make the modifications, the payback period is just over three years.

The results of this energy performance contracting pilot project are significantly improving Riverside Forest Products' business performance and, through the Council of Forest Industries, encouraging other forest-products manufacturers that wish to follow this company's lead.

WEYERHAEUSER CANADA LTD.



From Pulp Fiction to True Story – Energy Self-Sufficiency at Weyerhaeuser Canada Ltd.

Weyerhaeuser Canada has completed a $315-million project at its pulp and paper plant in Prince Albert, Saskatchewan, with a number of environmental and economic benefits. These benefits were made possible by converting an existing recovery boiler into a wood-waste boiler, thereby reducing the company's costs for natural gas and electricity. The massive project included introducing state-of-the-art stack monitoring and control systems and a new wood-waste processing and delivery system. Thanks to the company's actions to promote energy efficiency, Weyerhaeuser was able to shut down a second recovery boiler and two gas-fired package boilers.

The impact of the project has been dramatic. The Prince Albert plant has achieved energy self-sufficiency, eliminated landfilling waste wood and dramatically reduced its greenhouse gas emissions. At the same time, the project is enabling the plant to convert its existing stockpile of wood waste into useful energy over a 10-year period, while consuming all wood waste generated at the site and by other area sawmills. The project provides maximum value from wood waste by reducing annual natural gas use by up to 70 percent and cutting purchased power requirements by up to 50 percent.

SECTOR REPORTS

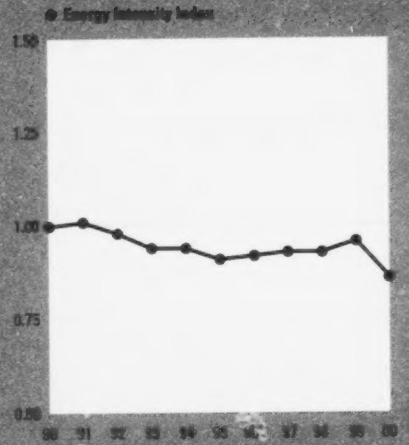
ALUMINUM

PROFILE: *Canada's aluminum sector ranks fourth in the world in annual primary aluminum production. The combined output of the industry's 10 aluminum plants in Quebec and one in British Columbia is a major contributor to Canada's national and local economies. Although production increases have forced the industry's total energy usage slightly upward, measurements of energy efficiency continue to demonstrate much improved performance compared with the benchmark 1990 levels.*

PERFORMANCE HIGHLIGHTS

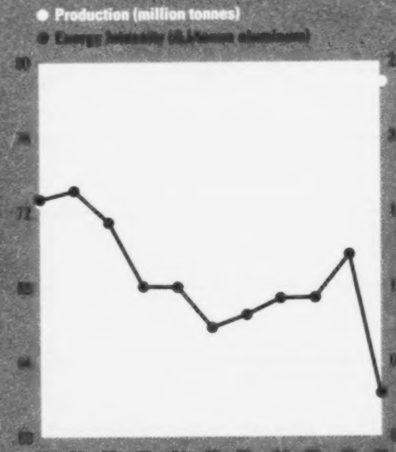
- Canada's aluminum sector is the world's fourth largest in primary aluminum production.
- Energy represents about one third of the total production cost of primary aluminum.
- The sector's energy efficiency is much improved over benchmark 1990 levels.
- Alcan Inc. announced that it plans to reduce its GHG emissions by 500 000 tonnes over the next four years.
- Alcoa inc. projects a minimum reduction in GHG emissions of 25 percent by 2010, with a 50-percent reduction possible if inert anode technology proves successful.
- Between 1995 and 2000, Aluminerie Alouette inc. reduced its specific power consumption by 7 percent while increasing metal production by 12 percent.
- Since 1990, the sector has reduced its CF$_4$ and C$_2$F$_6$ emissions by nearly 52 percent.

Aluminum Sector SIC 2951
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



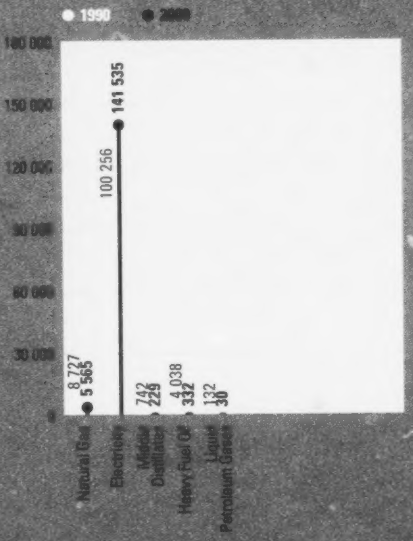
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Aluminum Sector SIC 2951
Energy Intensity and Physical Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Aluminum Sector SIC 2951
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC). *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

Primary aluminum production is energy intensive, with energy representing about one third of the total cost of production. This factor alone makes efficient energy management a prime objective for all smelters. Motivated by the need to control costs in an era of rising energy prices, sector members continue to actively pursue energy efficiency improvements.

For example, on October 9, 2001, Alcan Inc. announced that it plans to reduce its GHG emissions by 500 000 tonnes over the next four years through its TARGET program. Integrated into Alcan's business strategy, TARGET uses rolling objectives to continue to raise the bar in its environmental efforts. This program is the latest in a series of environmental initiatives implemented by Alcan. Other programs include the introduction of low-polycyclic aromatic hydrocarbons (low-PAH) pitch in its older smelters, the development of process improvements that reduce anode effects, fuel switching to use natural gas in fabrication facilities, improved product design and the promotion of increased aluminum recycling. As a result of its efforts, the company achieved a real GHG-emissions reduction of more than 2 million tonnes per year in the last decade.

On April 25, 2001, Alcoa inc. announced an ambitious long-term environmental program for all of its operations that is based on sustainable development principles. From a base year of 2000, Alcoa is committed to reduce SO_2 emissions by 60 percent by 2010, cut NO_2 emissions by 30 percent by 2007, substantially trim emissions of volatile organic compounds and mercury, and reduce land-filled waste and process water use before the end of the decade. Using a 1990 base year, the company projects a minimum reduction in GHG emissions of 25 percent by 2010, with a 50-percent reduction possible if inert anode technology proves successful. Through this program, Alcoa is committed to achieving a cost reduction of US$100 million by 2005 from energy and raw materials savings, environmental management cost reductions and recycling.

Between 1995 and 2000, Aluminerie Alouette inc. reduced its specific power consumption by 7 percent while increasing metal production by 12 percent. The company now uses 12 850 kWh (dc) of power to produce 1 kg of aluminum, the best performance in the world. In addition, a thorough review of power consumption by heating and air-conditioning systems led to the installation of 207 new programmable thermostats in 2001, enabling the plant's temperature and ventilation to be adjusted based on facility use. Aluminerie Alouette's state-of-the-art air-pollution control technology provides a 99-percent gas cleaning rate for particulates and fluorides. Between 1995 and 2000, Aluminerie Alouette's total GHG emissions were reduced by 30 percent.

The aluminum industry has also been active on climate change issues. In 2001, the Aluminium Association of Canada negotiated a covenant with the ministère de l'Environnement du Québec, committing to a voluntary reduction in GHG emissions through the end of 2007.

ACHIEVEMENTS

Primary aluminum production increased by 51 percent between 1990 and 2000, while GHG emissions remained stable. Over the same period, the sector reduced its GHG emissions per unit of production by more than 36 percent of CO_2 equivalent per tonne produced. Since 1990, the aluminum sector has reduced its emissions of tetrafluoroethane (CF_4) and hexafluoroethane (C_2F_6) by approximately 52 percent.

The aluminum industry is moving decisively to replace amorphous carbon cathode blocks with more efficient graphitized blocks. Although more expensive, graphitized blocks allow plants to boost reduction pot amperage without increasing voltage, thus producing more aluminum with each kilowatt of electricity. Several Canadian smelters that operate modern pre-bake technology have already switched to graphitized blocks. This measure, combined with other process-control improvements, enables an energy utilization factor of more than 98 percent – a performance unmatched by other industries.

To further the cause of energy efficiency, the sector has established aluminum recycling as an industry-wide priority. Aluminum is fully recyclable, and turning scrap into useful metal requires only 5 percent of the energy consumed in the production of primary aluminum. Improvements in recycling rates will not only divert aluminum from the waste stream; they will also improve the sector's overall energy intensity.

CHALLENGES

Although the industry will continue to make small energy efficiency gains through enhanced processes, the most significant improvements will come from the construction of new, state-of-the-art smelters. Such a transformation requires large capital investments and the availability of large quantities of electricity at highly competitive prices. Modern facilities currently account for 72 percent of total aluminum production. However, low aluminum prices combined with high energy costs will challenge the industry's ability to generate the funds needed to finance these investments. Developing workable economic models for the continued development of new facilities remains a significant industry challenge.

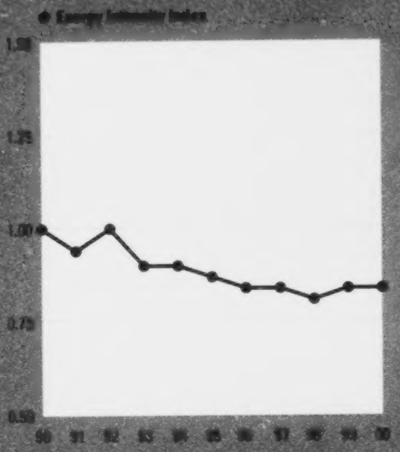
BREWERY

PROFILE: *Brewing in Canada is a diverse and modern industry that is actively pursuing ambitious energy efficiency targets. The industry is made up of two national brewing companies, several regional brewers and numerous microbreweries. Together, these establishments, which employ more than 14 000 workers in 83 breweries across Canada, produced more than 23 million hectolitres of beer in 2000.*

PERFORMANCE HIGHLIGHTS

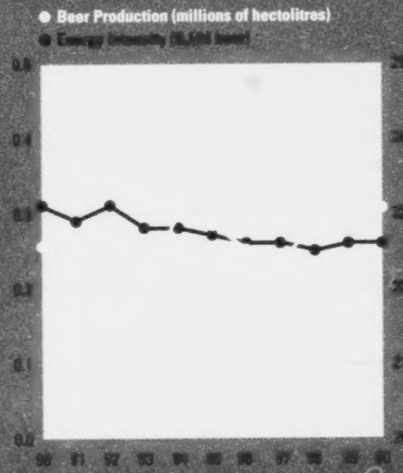
- The brewery sector employs more than 14 000 workers in 83 breweries across Canada.
- Enhanced maintenance, monitoring and control procedures are enabling brewers to identify and implement energy-saving measures.
- Compared with production in 1990, the industry has reduced its energy consumption by 17.5 percent per hectolitre of beer produced.
- The industry remains committed to an annual energy reduction of 1.0 percent over the next two years and, beginning in 2004, 1.5 percent annually through 2006.

Brewery Sector SIC 1131
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



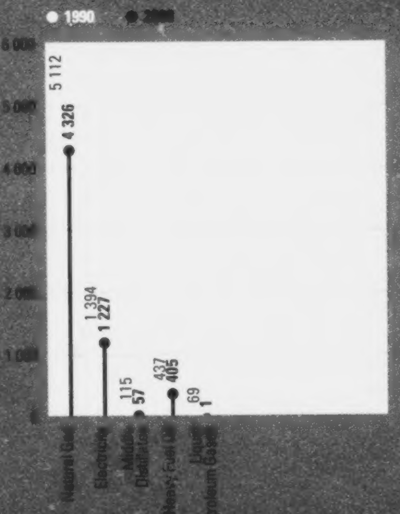
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Brewery Sector SIC 1131
Energy Intensity and Physical Output (1990–2000)

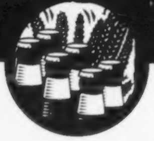


Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Brewery Sector SIC 1131
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.



ACTIONS

Canada's brewers continued to invest in efforts to increase energy efficiency. These measures consist of significant capital investments that encompass improvements to beer process and packaging facilities. The installation of new bottle-washing and pasteurization equipment is expected to achieve energy efficiencies and reduce GHG emissions.

Enhanced maintenance, monitoring and control procedures also have enabled brewers to identify opportunities for improvement and to implement energy savings. The measures taken include improvements to heating, ventilating, lighting and air-conditioning systems; waste-trimming enhancements to post-run shutdown procedures; and continued improvements in production process systems.

Companies are working to entrench accountability for energy and utility management throughout their organizations and at the same time ensure the sustainability of implemented projects and the identification of new projects. Energy audits and energy accountability help focus employees on energy waste reduction and conservation opportunities. Meeting regularly, energy committees of managers, technical support staff and workers at the plant level have been responsible for the incremental energy improvements in all functional areas. The benchmarking of energy and water usage performance, by individual companies and among breweries internationally, has identified best practices and opportunities to reduce energy consumption and emissions in brewing operations. Some breweries undertake powerhouse audits every week.

The 1998 publication *Energy Efficiency Opportunities in the Canadian Brewing Industry* remains an excellent reference for individual energy efficiency action plans. Developed through the Brewers Association of Canada's Environment Committee with Natural Resources Canada's support, the guide highlights a vast array of energy-saving opportunities and identifies ways that energy efficiency activities can reduce costs. The guide helps to further the sector's energy-reduction performance and demonstrates the industry's commitment to the reduction of GHGs in support of the Government of Canada's environmental objectives and international undertakings.

ACHIEVEMENTS

Compared with 1990, the industry now uses 17.5 percent less energy to produce a hectolitre of beer. In 2000, the industry consumed 6018 TJ of energy, 72 percent of which was natural gas, 7 percent fuel oil and 20 percent electricity. The brewing industry is committed to an energy-reduction target of 1.0 percent per year over the next two years and, beginning in 2004, 1.5 percent annually through 2006.

CHALLENGES

Cost control is a priority for the brewing industry. Flat sales since about 1975, greater competition from foreign brewers, increased competition from products such as coolers and growth in non-taxed alternatives (such as beer produced from kits and at "u-brews") have combined to weaken sales.

Brewers have responded to these challenges by developing export strategies that make Canada one of the top beer exporters in the world. Canada's brewers have also negotiated agreements that enable them to produce a number of products in Canada that would otherwise be imported. More than 350 distinct brands are now available in the Canadian market, from traditional ales and lagers to new products that have varying strengths of alcohol, flavours and textures. Clearly, the industry is well positioned to meet its competition head-on. Product and marketing innovations notwithstanding, energy remains a substantial cost component in the brewing process. Finding ways to improve energy efficiency is, therefore, a priority for Canada's brewers.

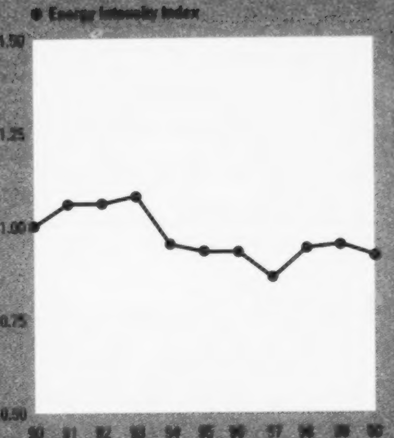
CEMENT

PROFILE: *The cement industry is the cornerstone of Canada's domestic construction industries and a significant exporter that contributes substantially to the country's balance of payments. The industry's eight companies, which operate 16 manufacturing facilities with a combined production capacity of 14.7 million tonnes of clinker, produced 12.4 million tonnes of cement in 2000.*

PERFORMANCE HIGHLIGHTS

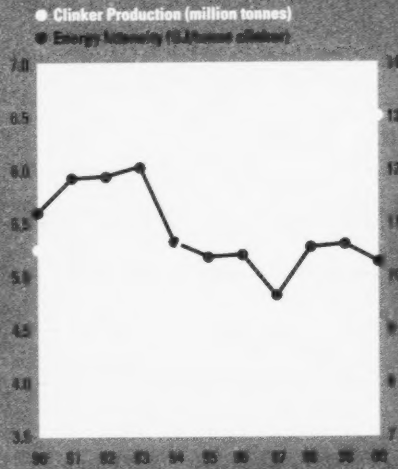
- The cement sector produced 12.4 million tonnes of cement in 2000.
- ESSROC Canada Inc. commissioned an indirect-firing and low-NO_x burner for its No. 4 kiln in April 2001.
- Ciment Québec Inc. has begun replacing engines in its limestone truck fleet in Saint-Basile, Quebec, with more efficient units.
- St. Lawrence Cement Inc. is installing a $5.5-million granular fuel system at its facility in Joliette, Quebec.
- St. Marys Cement introduced a series of energy efficiency initiatives at its plant in Bowmanville, Ontario.
- The use of alternative fuels increased to 3197 TJ, which is between 6.3 percent and 9.0 percent of total energy used by the cement sector in 2000.
- The cement sector anticipates that kiln efficiency will improve by 2 percent through the period 2000–2010.

Cement Sector SIC 3521
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



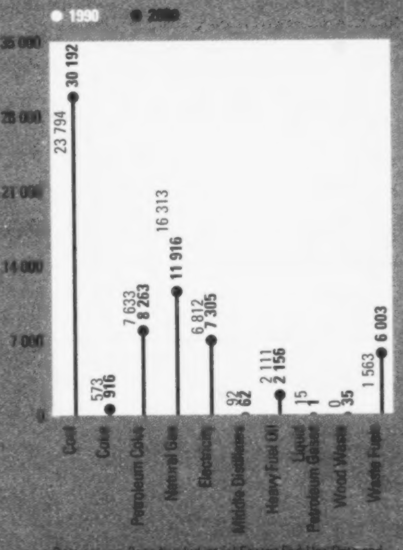
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Cement Sector SIC 3521
Energy Intensity and Physical Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002.

Cement Sector SIC 3521
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

Cement manufacturers continue to take action to improve energy efficiency. For example, at its facility in Picton, Ontario, ESSROC Canada Inc. commissioned an indirect-firing and low-NO_x burner on its No. 4 kiln in April 2001. ESSROC is also implementing a plant-wide, computerized electrical-energy monitoring program and is automating its No. 1 mill. These projects will be completed in 2002 and are expected to result in reduced electrical power consumption.

Ciment Québec Inc. of Saint-Basile, Quebec, has begun replacing engines in its limestone truck fleet. The company is replacing V16 diesel atmospheric engines, which each consume 400 litres of fuel per day, with new V8 electronic injection engines with a consumption rate of 320 litres per day. Four of seven 50-tonne trucks in the fleet have already been modified, with the last three to be converted in early 2002. When the program is complete, the company will save a total of 560 litres of diesel fuel per day, representing a fuel efficiency improvement of 20 percent.

Lafarge Canada Inc. has modernized (and expanded) its plant in Richmond, British Columbia. The five-stage, single-string pre-heater and associated calciner, along with a ventless clinker cooler design and high-efficiency pulse jet main baghouse, continue to ensure environmentally sound pyro-processing in the plant. The kiln feed system is based on an airlift pneumatic conveying system that is more efficient than a screw pump design. The airlift design best meets the plant's pre-heater lifting height requirement and brings simplicity and lower maintenance costs to the system.

St. Lawrence Cement Inc. is installing a granular fuel system at its facility in Joliette, Quebec, at a cost of $5.5 million. The granular system will allow the plant to burn waste materials, such as wood chips, tire fluff, rubber chips and dried sewage sludge in granular or chip form in two of its four kilns. Once the granular fuel system is commissioned in June 2002, waste fuels will replace about 42 000 tonnes per year of coal and coke. St. Lawrence also began producing high silica fume (HSF) cement at its plant in Mississauga, Ontario. When used as a replacement for clinker (the most energy intensive component of cement), HSF significantly reduces the energy needed to produce each tonne of finished product.

St. Marys Cement introduced a series of energy efficiency initiatives at its plant in Bowmanville, Ontario. The company replaced an inlet fan damper in its coal mill with a variable-inlet vane damper, saving about $75,000 in energy costs and reducing GHG emissions by 300 tonnes per year. The plant actively reviewed power-monitoring data and identified opportunities to reduce power consumption. A new kiln burner with superior flame control was installed, creating a more fuel-efficient system, and electricity consumption was cut by lowering the grind-out timing on cement finish mills. In early 2002, the Bowmanville plant will establish an interdepartmental energy-savings team to focus on reducing the plant's electricity consumption.

To benefit the 16 cement manufacturing plants across Canada, Natural Resources Canada through the CIPEC Cement Task Force published *Energy Consumption Benchmark Guide: Cement Clinker Production*. The guide allows plants to benchmark their operations by comparing energy use with that of other plants. By focusing on the way energy is used to produce cement clinker rather than finished cement, the guide is useful to a wider variety of plants.

The Cement Sector Task Force recently established an energy committee to help sector companies share information and develop joint actions on issues such as power deregulation, energy trends, the use of waste fuel, CO_2 emissions and fuel supply and demand. The group held its organizing meeting in January 2002.

ACHIEVEMENTS

The principal energy sources used for cement production are coal, natural gas and petroleum coke. Canada's cement sector has reduced its fuel consumption by an impressive 30 percent per tonne since the 1970s, principally by implementing major process improvements. The Cement Association of Canada calculates that, at the end of 2000, direct emissions of CO_2 per tonne of concrete product showed an 8-percent decrease compared with 1990, with a further 2-percent decrease projected by 2010. Kiln efficiency improved by 11 percent between 1990 and 2000.

Since 1990, the cement sector has managed to reduce its overall energy intensity by 8.4 percent while demand for its products increased 50.6 percent. The expanded use of power monitoring, targeting and other systems and technologies will combine with plant modernizations to further energy efficiency improvements within the sector.

The cement industry continues to work closely with governments and other industries to promote "concrete" solutions to environmental issues. For example, the intelligent use of cement-based products in the transportation, residential housing and agriculture sectors can improve energy efficiency and reduce GHG emissions in these sectors, thereby supporting Canada's Kyoto goals.

CHALLENGES

Energy is a substantial cost component in the production of cement, and energy efficiency gains can improve a company's competitive position in the marketplace. This makes energy consumption a competitive issue within the cement sector, leading many companies to treat energy cost-reduction information as confidential. However, there is a growing consensus among cement producers that the benefits of sector-wide cooperation outweigh the competitive risks. As it gains momentum, this shift in attitude should lead to a broadening of information sharing and cooperation among sector companies.

Long-standing discussions among waste producers and waste users have not yet yielded an appropriate methodology to establish emissions-related credits for waste material use in the production of cement. Moreover, the potential implementation of economic instruments such as a carbon tax could seriously impair Canada's cement exports. Fortunately, at the international level, where there have been long-standing difficulties establishing mutually acceptable protocols, sector companies have agreed to use calculating standards endorsed by the World Business Council for Sustainable Development.

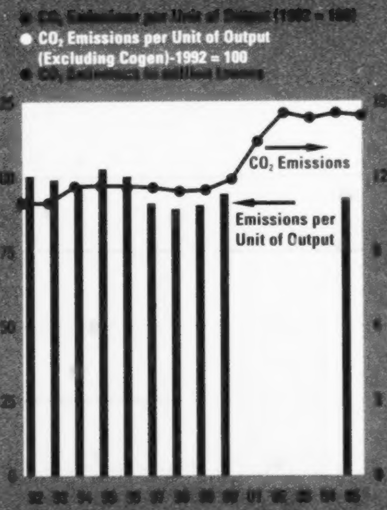
CHEMICAL

PROFILE: *The chemical sector encompasses a diverse industry that produces organic and inorganic chemicals, plastics and synthetic resins. The chemical industry is the third largest in Canada in terms of value of shipments. Companies in this sector operate 775 facilities Canada-wide, directly employing more than 24 000 people with an annual payroll of $1.3 billion. The Canadian Chemical Producers' Association (CCPA) is the trade association that represents manufacturers in this sector. Its member companies produce more than 90 percent of industrial chemicals manufactured in Canada.*

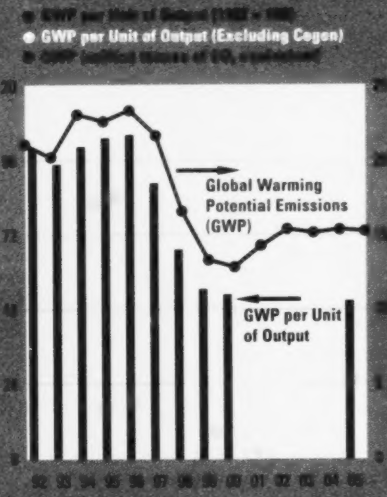
PERFORMANCE HIGHLIGHTS

- Companies in the chemical sector operate 775 facilities Canada-wide, directly employing more than 24 000 people.
- Companies that are members of the Canadian Chemical Producers' Association (CCPA) produce more than 90 percent of industrial chemicals manufactured in Canada.
- The CCPA prepared *Guidelines for Energy Efficiency and Greenhouse Gas Reporting* to assist member companies in their GHG-reduction efforts.
- In Alberta and Ontario, sector companies are using cogeneration technology to reduce CO_2 emissions produced by the utility sector.
- Ideas generated by a review of operations at Imperial Oil Limited's Products & Chemicals Division are expected to help reduce its annual energy bill by up to 20 percent.
- The sector's total GHG emissions in 2000, expressed as CO_2 equivalents, decreased 39 percent from 1992 levels.

Product Output vs. Carbon Dioxide Emissions from CCPA Member Operations



Product Output vs. Global Warming Potential of Emissions from CCPA Member Operations



Footnotes:

1. Chemical output and emission forecasts take into account announced capacity increases.
2. Historical output was calculated using constant 1992 dollars, taking into account average chemical pricing changes.

ACTIONS

The CCPA's policy statement on Responsible Care® incorporates a number of principles that provide detailed direction for reducing emissions. As they pertain to GHG emissions, these principles encourage members to:

- continuously reduce emissions with the goal of preventing unacceptable risk to the environment and human health;
- meet or exceed the letter and spirit of all legal requirements that affect operations or products;
- apply a broad range of options that include reducing, reusing, recycling and recovering and, as a last resort, end-of-pipe treatment solutions to effectively manage the environmental impact of processes; and
- assist governments and selected organizations to foster and encourage equitable and attainable standards.

In keeping with a commitment to continuous improvement, the CCPA prepared *Guidelines for Energy Efficiency and Greenhouse Gas Reporting* to assist member companies in their GHG-reduction efforts and held a workshop on emissions-estimation methods to help improve the accuracy of data.

CCPA member companies continued to pursue actions to promote energy efficiency. In Alberta and Ontario, members are using cogeneration technology to ease the demand on coal-fired power plants and reduce the CO_2 emissions per unit of energy produced by the utility sector. Most cogeneration plants use clean-burning natural gas as fuel rather than conventional oil-fired boilers and heaters, resulting in lower emissions of sulphur dioxide, carbon monoxide and particulate matter.

A good example is NOVA Chemicals Corporation's recently installed electricity/steam cogeneration power plant at the company's manufacturing facility in Joffre, Alberta. The cogeneration facility has reduced net emissions from the site from approximately 2.3 million tonnes per year to 1.2 million tonnes per year. Energy efficiency and technological improvements have led to an estimated 36-percent decrease in net CO_2 emissions and a 52-percent decrease in NO_x emissions per unit of production. The company projects that by the year 2004 its net emissions will be below 1990 levels.

Other companies have also taken major steps to improve energy efficiency. Imperial Oil Limited's Products & Chemicals Division in Sarnia, Ontario, assembled 20 international experts in 2000 to review current operations in light of leading energy-conservation practices. The review generated more than 150 opportunities to reduce steam, fuel and electricity consumption – ideas covering everything from operating changes to more sophisticated control systems. The Sarnia site expects to reduce its annual energy bill by up to 20 percent – the equivalent of heating 20 000 local area homes for a year – when its four-year improvement plan is completed.

ACHIEVEMENTS

In 2000 the chemical sector's energy consumption totalled 217 552 TJ, a 14-percent increase over 1992 levels. However, the constant dollar value of the industry's products, used as a measure of output, increased 16 percent over the same period and increased 4 percent from 1999 to 2000. From 1992 to 2000, CO_2 emissions levels increased 9 percent, and CO_2 emissions per unit of output decreased 9 percent. Total GHG emissions in 2000, expressed as CO_2 equivalents, decreased 39 percent from 1992 levels.

In 2000, emissions of methane declined by 27 percent, sharply reversing the trend of increasing methane emissions experienced prior to 1997. Similarly, emissions of nitrous oxide continued to decline with a decrease of 49 percent, for a total decrease of 91 percent since 1992. Measured in terms of global warming potential, emissions in 2000 were 4 percent lower than in 1999 and 39 percent lower than in 1992.

GHG emissions from CCPA-member companies are projected to be 28 percent lower than 1992 levels by 2005. The CCPA estimates that total CO_2 emissions per unit of output will decrease by an additional 2 percent by 2004, 8 percent less than in 1992. Including cogeneration, members expect a 32-percent increase in total emissions of CO_2 by 2005 compared with 1992. By 2005, GHG emissions expressed in terms of global warming potential per unit of output are projected to decrease by 49 percent compared with 1992, or 59 percent when excluding cogeneration emissions.

CHALLENGES

Considering the priority that Environment Canada and provincial environment ministries have placed on air quality, CCPA members have an ongoing challenge to reduce emissions while maintaining growth in their operations. In practical terms, members are guided by both technological and economic considerations in the simultaneous pursuit of improved environmental performance and enhanced global competitiveness.

Over the past decade, the energy demands of CCPA members have increased with increased levels of production. Despite the pressures of growth, member companies have been able to reduce their CO_2 emissions per unit of product. This improvement in efficiency can be partly attributed to the chemical sector's integration into an international market that demands that Canadian facilities continually invest significant capital to remain competitive with other regions.

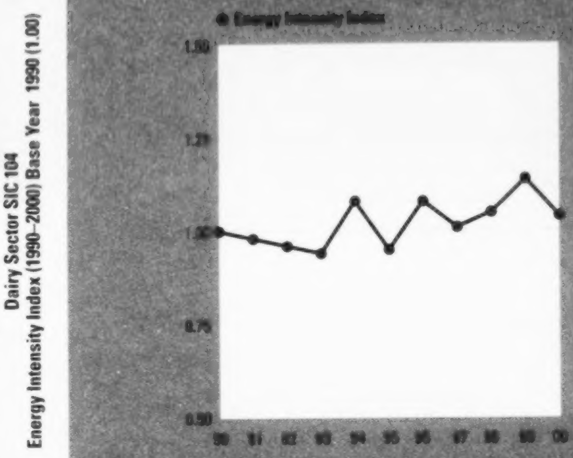
Continued growth in the chemical industry makes it likely that, although CO_2 emissions per unit of output will continue to improve, total CO_2 emissions will grow. The dramatic changes already made through application of cogeneration and nitrous oxide abatement technologies will be difficult to replicate.

DAIRY

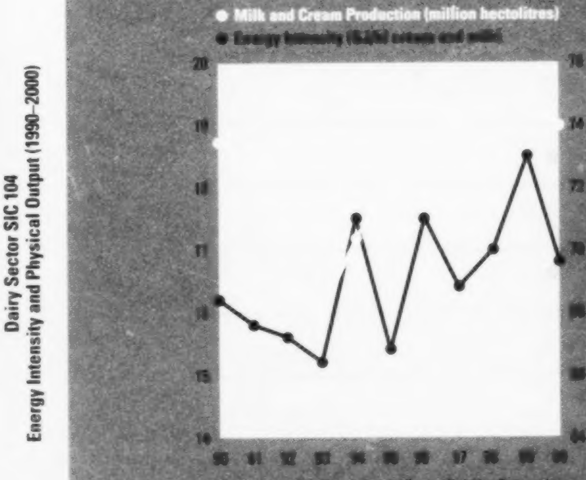
PROFILE: *Canada's dairy product manufacturing sector spans Canada from coast to coast. Operating from more than 270 facilities and employing 20 500 people, Canada's dairies processed more than 73 million hectolitres of raw milk and shipped an estimated $5.9 billion worth of milk products in 2000.*

PERFORMANCE HIGHLIGHTS

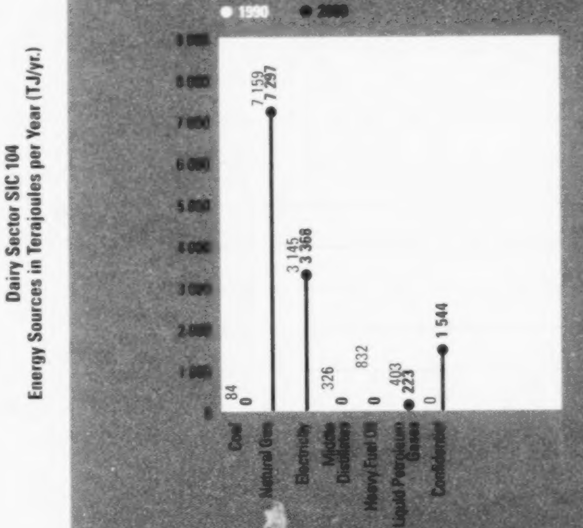
- Canada's dairies shipped products worth an estimated $5.9 billion in 2000.
- Dairies have implemented dozens of energy-saving process improvements – from thermal storage of recovered hot water to exterior tanker recycled water washes, lighting upgrades and improved control of air and water leakage.
- A systematic approach to energy efficiency enabled Kraft Canada Inc. to reduce its 2000 energy consumption per unit of production by 2.2 percent compared with 1999 – 7.1 percent below 1994 levels.
- Parmalat Dairy and Bakery Inc. made energy efficiency investments that have led to annual energy savings of $265,000.
- In 2000, the sector's total energy consumption was 12 434 TJ, up from the 1990 level of 11 952 TJ.
- The sector's energy intensity is increasing due to consumer demand for products that require more energy to produce.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

Energy is a key component in milk processing. Typically, dairies employ electrical, thermal and water-based energy systems in their facilities for processes such as pasteurization, churning, washing, packaging, cooling, freezing and drying. Over the years, the importance of energy to the sector has led the Dairy Sector Task Force to promote industry-wide participation in efforts to improve energy efficiency.

Significant gains are coming from low-cost, no-cost and retrofit improvements throughout the industry's plant operations. Dairies have implemented dozens of such energy-saving programs – from the establishment of thermal storage of recovered hot water to the introduction of exterior tanker recycled water washes to lighting upgrades and improved control of air and water leakage.

Kraft Canada Inc. provides an excellent example of the results that can be achieved through an ongoing, systematic approach to energy efficiency and GHG reduction. In 2000, the company's total energy consumption decreased by 2.7 percent compared with 1999 and decreased 10.2 percent compared with the company's 1994 base year. Energy consumption per unit of production was 2.2 percent lower in 2000 than in 1999 and 7.1 percent below 1994 levels. Moreover, CO_2, CH_4 and N_2O emissions have declined steadily over the past five years, with 2000 CO_2 levels registering a nearly 13-percent improvement compared with 1996.

The facility of Saputo Inc.'s Milk Division in Edmonton, Alberta, involved management, production and maintenance employees in a review of its production profile requirements during 2001. The company reviewed its production schedules, processes and work force in order to find ways to eliminate waste and optimize energy use. With employees throughout the facility involved, the review led to a 7.5-percent reduction in electricity use.

Parmalat Dairy and Bakery Inc. realized significant energy savings in its plants by introducing a number of improvements. For example, the company installed an improved air-compressor system at one location, saving $20,000 per year in energy costs. Parmalat also installed boiler waste-heat recovery systems at two facilities and upgraded steam-distribution systems at three locations, leading to combined savings of $245,000 per year.

William Nielson Ltd. now recovers cooling water from its air compressors for use in its hose drops, tank line pre-rinses and truck washes at its facility in Ottawa, Ontario. The plant has also installed a closed loop cooling system for its ammonia compressors. The dairy's cooling water recovery program has reduced the company's water use and enabled it to conserve steam, thereby cutting its energy consumption.

The Dairy Sector Task Force provides companies that are seeking to make such improvements with information on expected cost savings and payback periods. In partnership with Natural Resources Canada, the task force supports the energy efficiency achievements of dairy plant managers through research and educational materials. One such report, entitled *Energy Performance Indicator Report: Fluid Milk Plants,* developed benchmarks for energy efficiency in Canadian fluid milk plants and established a methodology that is specific to the dairy industry in order to examine plant energy performance. The study also reviewed potential energy-saving ideas that are appropriate for the milk processing industry.

ACHIEVEMENTS

The dairy sector has made significant progress toward lowering its costs through improved energy efficiency. In 2000, the dairy product manufacturing sector's total energy consumption was 12 434 TJ, up slightly from the 1990 level of 11 952 TJ. The amount of milk and cream produced in 2000 was also up from 1990 levels. Except for a peak year in 1994, energy intensity remained at or below the 1990 level until 1996, when consumer demand for more energy intensive products offset the sector's progress in improving energy efficiency. Despite upward pressures, the energy consumed per hectolitre of output decreased in 2000 to 1.68 GJ from 1.85 GJ in 1999.

CHALLENGES

The promotion of energy efficiency efforts in the dairy sector suffered a temporary setback in August 2001 when the National Dairy Council of Canada, the driving force behind the sector's participation in CIPEC, was disbanded. The sector has re-established the task force, nominated a new Chair and is now in the process of rebuilding its energy task force and recruiting provincial dairy associations.

With rapidly fluctuating energy prices and limited availability of capital, developing a sound business case for investments in energy efficiency is a significant challenge for dairy product manufacturers. In addition, rationalization and competitive pressures continue to drive the industry to reduce excess capacity in the face of static sales.

Although the sector's main source of raw milk is highly regulated, the marketplace demands that dairy product companies provide innovative, high-quality, value-added products at the best possible prices. Unfortunately, creating the products consumers want often conflicts with efforts to improve energy efficiency. For example, producing the increasingly popular extended-shelf-life products requires ultra-high-temperature pasteurization and other processes that use significantly more energy per unit of output.

Manufacturers have already made the most of the low-cost and no-cost energy efficiency improvements available to them. Their greatest challenge going forward is to make the more costly, payback-delayed improvements that will further advance energy efficiency.

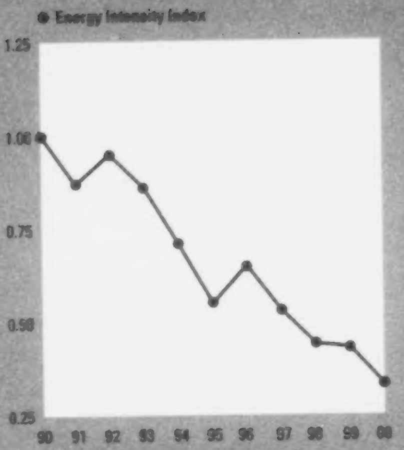
ELECTRICAL AND ELECTRONICS

PROFILE: *The electrical and electronics sector includes a diverse array of companies that produce electrical appliances, lighting, consumer electronics, communications and electronic equipment, cabling, office equipment, industrial equipment and other electrical products. These companies operate more than 1400 facilities and employ more than 100 000 workers across Canada. The industry is a major exporter and a vital, growing contributor to the national economy.*

PERFORMANCE HIGHLIGHTS

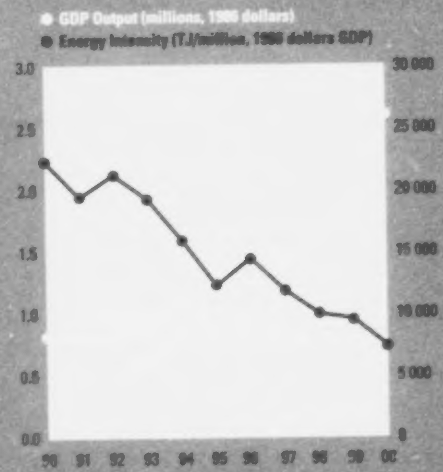
- The electrical and electronics sector is Canada's least energy intensive industry.
- IBM Canada Ltd. reduced energy consumption by 29 percent between 1990 and 2000 despite an increase in business revenues.
- Nortel (Northern Telecom Limited) reduced total energy consumption in its Canadian operations by 14 percent from 1997 through 2000.
- Between 1990 and the end of 2000, the sector's energy consumption remained relatively constant despite substantial growth in production.
- The sector has decreased its energy intensity by 67.26 percent from 1990 through 2000.
- The industry anticipates a significant decrease in energy consumption over the next decade.
- Many sector products decrease CO$_2$ emissions by increasing the energy efficiency of other industries.

Electrical and Electronics Sector SIC 33
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



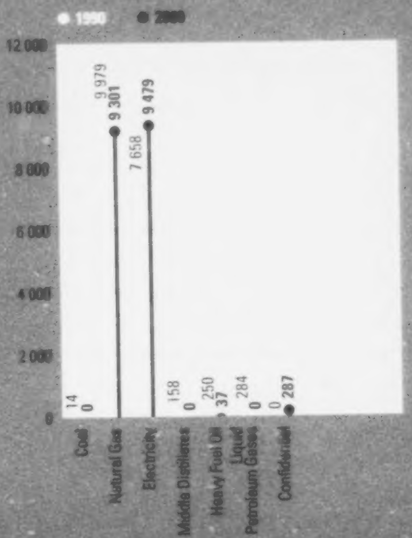
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Electrical and Electronics Sector SIC 33
Energy Intensity and Economic Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Electrical and Electronics Sector SIC 33
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

Companies that operate in the electrical and electronics sector are strong proponents of environmental sustainability and energy efficiency. Although the industry is one of Canada's least energy intensive, many companies have incorporated energy efficiency programs as vital components in their efforts to control costs.

For example, by the end of 2000, energy efficiency measures taken by IBM Canada Ltd. combined to reduce the company's energy consumption from the equivalent of 591 000 MWh in 1990 to 419 947 MWh in 2000, a 29-percent reduction, despite an increase in business revenues. The year-to-year carbon dioxide equivalent (CO_2e) reductions achieved in 2000 were 10 percent, the best single-year result that the company has achieved. Energy-conservation projects implemented in 1999 and energy efficiency upgrades to computer systems contributed most to the GHG-emissions reduction. To date, IBM Canada has reduced its cumulative emissions by 26 416 tonnes since 1990. This is equivalent to an average annual reduction of 2642 tonnes per year, or a 28-percent reduction in emissions relative to 1990 levels. IBM Canada is committed to a 4-percent-per-year reduction in GHGs and projects energy savings of between 4 and 8 percent in 2001.

In an effort to improve energy efficiency throughout its organization, Nortel (Northern Telecom Limited) has implemented a program called Total Energy Asset Management (TEAM). TEAM focuses on identifying opportunities for energy savings and on developing cost-effective sources of supply for energy-efficient equipment and systems. As part of the TEAM approach, Nortel uses benchmarking, an energy management evaluation tool, auditing, reporting and a number of planning and management tools to minimize the cost of energy efficiency programs while maximizing their impact. Company-wide, Nortel has undertaken energy-reduction projects that include the installation of motion-detecting lighting systems and computerized air-conditioning and heating systems, the conversion of oil-fired boilers to natural gas, and the consolidation of operations to reduce the number of buildings occupied. In addition, the company has introduced an employee telecommuting program and a "green" commuting program at its facility in Ottawa, Ontario, that reduces automobile-produced GHGs by minimizing employee travel. As a result of these programs, Nortel reduced total energy consumption in its Canadian operations by 14 percent from 1997 through 2000, cutting its GHG emissions by a total of 3 926 000 tonnes.

ACHIEVEMENTS

Natural gas and electricity satisfy virtually all of the electrical and electronics industry's energy requirements. Between 1990 and 2000, the sector's GDP increased by 218 percent. In 2000, the industry consumed 19 104 TJ of energy, representing 0.7 percent of the energy consumed by the manufacturing sector as a whole and less than 1 percent of total energy-related manufacturing CO_2 emissions. On average, energy expenditures represent less than 1 percent of the value of the industry's shipments compared with more than 61 percent for materials and supplies and 16 percent for labour.

Between 1990 and the end of 2000, the sector's energy consumption remained relatively constant despite substantial growth in production. These factors have combined to decrease energy intensity by 67.3 percent. Consolidation of facilities resulting from acquisitions and mergers as well as internal rationalization is bringing the industry increased efficiencies of scale, which should lead to a significant decrease in energy consumption over the next decade.

The sector contributes to Canada's overall energy efficiency and GHG programs in other ways. Many sector products, from oil refinery control systems to high-efficiency motors and lighting, are used directly by companies in other sectors in order to decrease their energy consumption.

CHALLENGES

A difficult world economy and soft international markets for many sector products has led many electrical and electronics companies to put energy efficiency projects that require capital investment temporarily on hold. Energy is not a major cost component for most sector manufacturers, making energy efficiency less critical to the industry's health than technological change, market growth and sales and distribution issues. In addition, manufacturers must compete with foreign competitors that operate in countries that have fewer environmental constraints. Unilateral Canadian actions to reduce GHG emissions in response to the Kyoto Protocol can place Canadian plants at a competitive disadvantage that cannot be offset by the cost savings brought by reductions in energy use. In an industry prone to rapid and dramatic changes, most companies focus on the next two fiscal quarters, making a commitment to long-term targets difficult to justify.

ELECTRICITY GENERATION

PROFILE: *The electricity generation sector produces the electrical energy that powers industry, business and homes across Canada. Using water, fossil fuel, nuclear energy and alternative energy sources, the sector produced 58 753 GWh in 2000, meeting Canada's domestic energy needs while earning more than $1 billion in export revenues each year.*

PERFORMANCE HIGHLIGHTS

- TransAlta Utilities Corporation has established a $100-million Sustainable Development Research and Investment Fund.
- BC Hydro Corporation erected, or partnered in erecting, five wind-speed monitoring towers in 2000.
- Yukon Energy Corporation commissioned a new wind turbine to potentially displace about 350 000 litres of diesel fuel generation.
- ENMAX Energy Corporation bought a total of 1.4 million kWh of wind power for its South Service Centre.
- Ontario Power Generation Inc. plans to invest $50 million by 2005 to increase its green energy capacity.
- A partnership between Ontario Hydro Energy and Sears Canada Inc. has reduced Sears' energy costs by $22,000 monthly.
- BC Hydro Corporation replaced its 80-year-old, 52.5-MW power plant at Stave Falls, British Columbia, with a new, high-efficiency, two-unit 90-MW power plant.
- ATCO Electric's Battle River Generating Station has implemented technology that reduces particulate emissions by 27.5 percent.
- Alberta utility EPCOR made the world's largest trans-Atlantic trade of CO_2 emissions offsets.

The sector is currently working with the Office of Energy Efficiency of Natural Resources Canada to develop indices and figures.

ACTIONS

The electricity industry has demonstrated its commitment to environmental responsibility through the establishment of the Environmental Commitment and Responsibility (ECR) Program. This comprehensive program was developed and implemented by the major electrical utility companies in Canada and coordinated through the Canadian Electricity Association (CEA). Participation in the ECR Program is a requirement of CEA membership.

The main components of the program include a declaration of environmental principles and a continually improving set of environmental indicators. All participants must implement a formal environmental management system that is consistent with ISO 14001 standards in order to reduce impacts by using best environmental and business practices. The program is independently verified and is subject to a public advisory panel review.

Canada's electricity industry is rising to the challenges of energy efficiency, air quality and emissions. In the lab, Canadian utilities are pursuing ways to reduce CO_2 emissions, including fuel switching, the development of alternative generation sources, the adoption of more efficient or lower-emissions technologies and the altering of operating and maintenance procedures. In the boardroom, many utilities are delivering programs that encourage customers to use electricity more efficiently and to use it during off-peak hours. Some utilities are investing in projects that provide sinks that absorb emissions, such as increased forest cover, to offset some of the industry's own emissions until feasible solutions to reduce emissions directly can be found.

Individual electricity producers are taking significant steps toward energy efficiency and the reduction of the industry's impact on the environment. For example, TransAlta Utilities Corporation has established a $100-million Sustainable Development Research and Investment Fund for investments in renewable energy, carbon-offset projects, and the research and development of clean coal technology.

BC Hydro Corporation has set a goal of meeting 10 percent of new electricity demand with energy from "green" resources. To that end, the utility erected, or partnered in erecting, five wind-speed monitoring towers in 2000 to determine the true size of the wind resource at specific locations. BC Hydro also completed the first wind energy resources map of British Columbia, generated through computer modelling.

Yukon Energy Corporation has commissioned a new wind turbine to generate enough power for 130 homes – potentially displacing about 350 000 litres of diesel fuel generation and reducing CO_2 emissions by nearly 1000 tonnes per year. In addition, Yukon Energy's House Calls Program sends trained technicians to visit homes serviced by diesel generation to discuss energy efficiency, demonstrate products and educate households about climate change.

The Alberta utility ENMAX Energy Corporation bought a total of 1.4 million kWh of wind power for its South Service Centre. Nearly 2000 customers of wind-generated power enable ENMAX to leave an estimated 113 000 tonnes of coal in the ground.

Ontario Power Generation Inc. plans to invest $50 million by 2005 to increase green capacity from 138 MW (or 0.5 percent of generation in 2000) to 500 MW (or 2 percent of generation by 2005).

A partnership between Ontario Hydro Energy Inc. and Sears Canada Inc. has led to the replacement of the lighting system at Sears' 130 000-m^2 (1.4-million-sq.-ft.) catalogue distribution centre in Belleville, Ontario. The three-month project involved installing energy-efficient electronic ballasts in place of old magnetic ballasts in thousands of fluorescent ceiling fixtures. The partnership has reduced Sears' energy costs by $22,000 monthly.

In 2000, BC Hydro replaced its 80-year-old, 52.5-MW power plant at Stave Falls, British Columbia, with a new, high-efficiency, two-unit 90-MW power plant. The facility now provides electricity to 35 000 homes – 7000 more than it was previously able to serve.

SaskPower plans to install improved gas-fired generation technology at its Queen Elizabeth Power Station. The company will install six 25-MW gas turbines along with equipment designed to produce additional electricity from exhaust gas heat with a 30- to 45-percent increase in efficiency.

ATCO Electric's Battle River Generating Station in Forestburg, Alberta, has implemented an experimental Skewed Gas Flow Technology (SGFT) that enhances precipitator performance. The new technology reduces particulate emissions by 27.5 percent.

Alberta utility EPCOR made the world's largest trans-Atlantic trade of CO_2 emissions offsets. The deal between EPCOR and Fortum Corporation of Finland transferred 50 000 tonnes of CO_2-equivalent emissions offsets. EPCOR sees emissions trading as a useful initiative to reduce environmental impacts while balancing economic and environmental activities.

ACHIEVEMENTS

Manitoba Hydro was recognized by Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) as a Gold Level Champion Reporter, the highest level of achievement in VCR Inc.'s Champion Reporting system. Centra Gas Manitoba Hydro Inc. was recognized as a Silver Level Champion Reporter. BC Hydro's *Greenhouse Gas Report* earned VCR Inc.'s Gold Level Reporter status for the utility's management of GHG emissions during 1999. BC Hydro was also the only electric utility in 2000 to receive a Leadership Award from VCR Inc., recognizing the company for achievements in public outreach, reducing GHG emissions and overall leadership in GHG management.

CHALLENGES

The search by electrical utilities for better air quality and lower emissions is fuelled by a desire to pass on a better, cleaner world to the next generation. In early 2000, the CEA opened discussions with federal and provincial governments aimed at developing an agreement on GHG-emissions performance. CEA members put forward a proposal called the Emissions Performance Equivalent Standard (EPES). CEA's proposal would reduce net CO_2 emissions by 20 percent in 2020. However, there are difficulties in establishing a formula that is agreeable to both government and industry. Parties to the discussions have agreed to start by developing a broad framework agreement that encompasses all actions that could reduce the growth of GHG emissions from the electric power sector and provide a base for negotiation of more specific emissions limitations commitments.

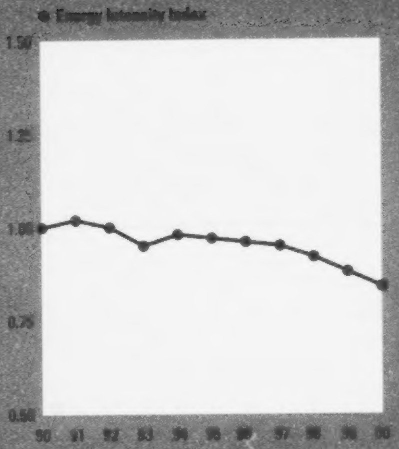
FERTILIZER

PROFILE: *Canada's fertilizer industry is one of the world's major producers and exporters of nitrogen, potash and sulphur fertilizers, manufacturing 12 percent of the world's total fertilizer materials. Companies in this sector operate more than 30 production facilities and are among the world's most energy-efficient producers.*

PERFORMANCE HIGHLIGHTS

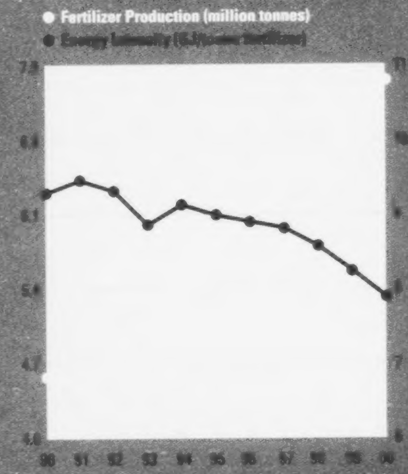
- Canada's fertilizer industry is one of the world's major producers and exporters of nitrogen, potash and sulphur fertilizers.
- The Canadian industry is among the most energy efficient compared with its global competitors.
- In 2001, the Canadian Fertilizer Institute (CFI) and Natural Resources Canada initiated a benchmarking study of the fertilizer sector.
- Potash Corporation of Saskatchewan Inc. divisions reported a number of energy efficiency improvements in 2000.
- A cogeneration project at Agrium Inc.'s Carseland Nitrogen Operations is expected to offset more than 300 000 tonnes of CO_2-equivalent GHG emissions annually.
- Fuel energy efficiency in the production of nitrogenous fertilizers has improved by about 15 percent over an 11-year period.
- The CFI concluded a comprehensive study of carbon sequestration in agricultural soils.
- Nitrogen fertilizer production increased from 6.8 million tonnes in 1990 to 10.8 million tonnes in 2000.

Fertilizer Sector – Nitrogenous SIC 3721
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



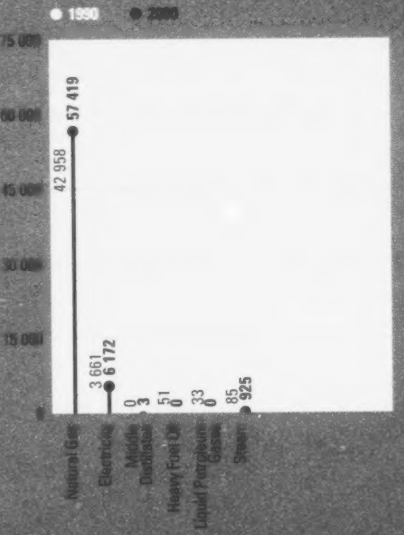
Data source: Canadian Fertilizer Institute (CFI), March 2002.

Fertilizer Sector – Nitrogenous SIC 3721
Energy Intensity and Physical Output (1990–2000)



Data source: CFI, March 2002.

Fertilizer Sector – Nitrogenous SIC 3721
Energy Sources in Terajoules per Year (TJ/yr.)



Data source:
(1) "Natural gas 1990–2000," CFI, March 2002.
(2) "Other fuels 1990–2000," Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), Development of Energy Intensity Indicators for Canadian Industry 1990–2000, January 17, 2002, Simon Fraser University.

ACTIONS

Canada's fertilizer industry has undertaken special research projects on a number of fronts. In 2001, the Canadian Fertilizer Institute (CFI) and Natural Resources Canada initiated a benchmarking study of the fertilizer sector in an effort to review currently available information and develop options for a sector energy-benchmarking protocol. Also in 2001, the CFI concluded a comprehensive study of carbon sequestration in agricultural soils under various regimes of fertilizer use and agricultural practices. A formal report will be issued early in 2002.

To find ways to increase agricultural productivity while reducing environmental impact, the CFI and its member companies have launched a three-year study of nitrous oxide emissions from fertilizer use. In another project, CFI commissioned a study to account for GHG creation and consumption throughout the life cycle of fertilizer production and use.

Individual companies were also active contributors to the sector's energy efficiency efforts, including several divisions of the Potash Corporation of Saskatchewan Inc. (PCS). PCS – New Brunswick completed a number of projects that are now paying off in improved energy efficiency, including heat recovery enhancements to its No. 1 crystallizer, thermal insulation of process equipment, and an energy-conservation information program for employees. The division has steadily reduced the total energy consumed per tonne of production from 2.05 GJ per tonne in 1993 to 1.67 GJ per tonne in 2000.

PCS – Patience Lake improved the efficiency of its recovery well pumps, eliminated mill equipment, installed heat recovery equipment on its brine system, decommissioned its fines dissolver burners and lowered operating temperatures in the compaction circuit.

PCS – Rocanville improved its energy efficiency by replacing a tails filter and cyclones with a more efficient unit, replacing four flotation cells with a column flotation unit and modifying the bit patterns on the cutting heads of its automatic miners to improve energy efficiency.

PCS – Cory installed a revised product-cycloning and centrifuging circuit to improve product recovery, replaced obsolete heating and ventilating equipment, replaced incandescent lighting with higher-efficiency metal halide light fixtures, and promoted energy efficiency among its work force through its employee newsletters.

In a joint venture cogeneration project with TransCanada Pipelines Limited completed in early 2002, Agrium Inc.'s Carseland Nitrogen Operations near Calgary, Alberta, uses gas turbines to produce about 80 MW of electrical power for export into Alberta's power grid, thereby reducing the need for coal-generated electricity. Agrium uses waste heat from the turbine exhaust to reduce natural gas consumption for steam generation. The project is expected to offset more than 300 000 tonnes of CO_2-equivalent GHG emissions annually.

ACHIEVEMENTS

According to the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), nitrogen fertilizer production increased from 5.4 million tonnes in 1990 to 6.8 million tonnes in 2000. However, results of the Fertilizer Sector Task Force data-quality project indicate that production of nitrogenous fertilizers increased from 6.8 million tonnes in 1990 to 10.8 million tonnes in 2000. The task force reports that the natural gas consumed as fuel in this production was 57 419 TJ in 2000 versus 42 958 TJ in 1990. This represents an improvement in fuel energy efficiency of approximately 15 percent over the 11-year period.

Based on CIEEDAC data, since 1990, potash production has increased some 35 percent, for a total of 9.41 million tonnes in 2000. Overall, energy indicators show an improvement in energy intensity that averages more than 1 percent per year since 1990.

Internationally, the Canadian fertilizer industry ranks among the lowest GHG emitters per unit of output. However, the manufacture of fertilizer requires significant natural gas and other inputs for both feedstock and energy and therefore generates emissions of GHGs, primarily CO_2. Fertilizer use also results in some GHG emissions. On the other hand, the fertilizer industry plays an important role in carbon sequestration – fixing CO_2 in agricultural soils. Carbon sequestration in "agricultural sinks" offsets to a substantial degree the environmental impact of energy consumption during the manufacturing process. Agricultural sinks could be a key component of a national short-term approach to reducing net national CO_2 emissions.

CHALLENGES

Canada's Kyoto goals have special significance to the fertilizer industry – a major energy consumer. In fact, despite the Canadian industry's international energy efficiency leadership, manufacturers could be at considerable risk if inflexible climate change policy scenarios are introduced. Current and projected energy efficiencies cannot offset the increasing demand for fertilizers that result from growing world food needs. This demand, in turn, will push total manufacturing energy consumption upward in spite of the industry's best reduction efforts.

However, the CFI believes that although gains in manufacturing energy efficiency will come in small increments, major reductions in the GHG impact of fertilizers can come from improvements in their use. The fertilizer industry supports research and other efforts that serve to improve the efficiency of fertilizer use and to foster best practices approaches within Canada's agricultural community. The industry believes that the right mix of policies, practices and economic incentives could have a substantial impact on the global effort to reduce GHG emissions. Conversely, focusing solely on the energy used by Canada's fertilizer industry could inadvertently increase global GHG emissions and exacerbate the world's food shortages.

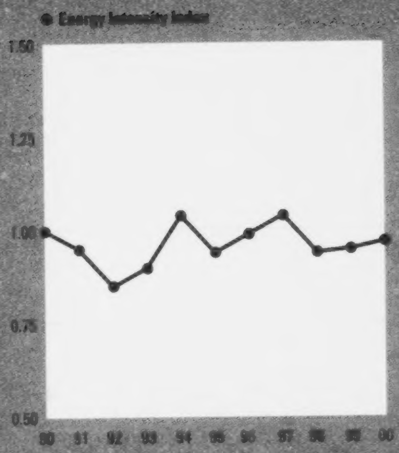
FOOD AND BEVERAGE

***PROFILE**: Canada's food and beverage sector includes manufacturers that produce a diverse range of products, including meat, poultry, fish, fruit and vegetables, flour and bakery products, oils and sugars, coffee, snack foods, soft drinks and confections.*

PERFORMANCE HIGHLIGHTS

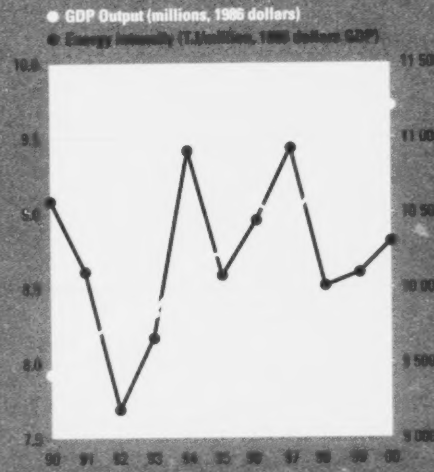
- Kraft Canada Inc. has reduced raw make-up water demand by 95 percent by reusing hot condensate from a whey evaporator as boiler feed-water make-up at its plant in Ingleside, Ontario.
- D.C. Food Processing Inc. installed a new direct-contact water heater with an energy efficiency rating of 99.7 percent, saving 19.7 percent in energy costs.
- To assist the food and beverage sector, Natural Resources Canada's Office of Energy Efficiency held two customized "Dollars to $ense" workshops for the sector in 2001.
- From 1990 to 2000, food processors improved their collective energy intensity by 3 percent.
- For the years 2000 to 2005, the sector anticipates an average reduction in energy use of 2.2 percent per year.

Food Sector SIC 10 (including Dairy SIC 104)
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



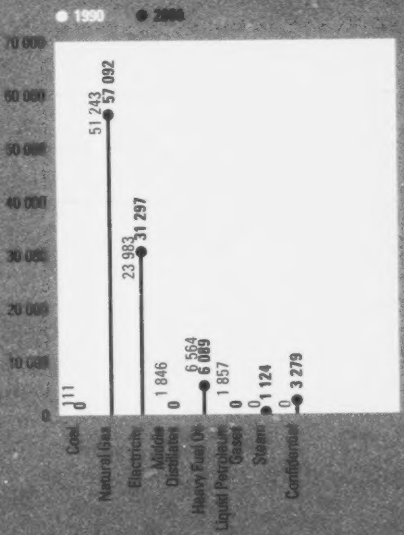
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.
Note: Includes data for Dairy Sector (SIC 104).

Food Sector SIC 10 (including Dairy SIC 104)
Energy Intensity and Economic Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.
Note: Includes data for Dairy Sector (SIC 104).

Food Sector SIC 10 (including Dairy SIC 104)
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.
Note: Includes data for Dairy Sector (SIC 104).

ACTIONS

In 2001, the Food and Beverage Sector Task Force met three times, prior to CIPEC Task Force Council meetings. Sector meetings were hosted by the Food and Consumer Products Manufacturers of Canada, a CIPEC partner since 1999. Other partners include the Canadian Meat Council, the Baking Association of Canada, the Canadian Council of Grocery Distributors, and the sector's newest partner, the Fisheries Council of Canada, which joined in 2001. Interest in the task force's activities have also been expressed by the New Brunswick Seafood Processors Association, the PEI Seafood Processors Association and the Nova Scotia Fish Packers Association. Food sector meetings have included presentations by third parties, such as DML Control International and the Canada Centre for Mineral and Energy Technology (CANMET), providing valuable new information for CIPEC members.

Individual sector companies maintained active energy efficiency programs in 2000/2001. Following are examples.

At its plant in Ingleside, Ontario, Kraft Canada Inc. is now capturing hot condensate from a whey evaporator to use as boiler feed-water make-up. The company installed a condensate polisher and appropriate controls to feed the polished condensate to the feed-water de-aerator. The project was completed in spring 2001. This program has decreased the blowdown percentage from 3 percent to 1 percent, thus saving water and heat. Raw make-up water demand has decreased by 95 percent from an average daily consumption of 23 000 gallons to 1000 gallons, leading to annual water savings of more than 5 million gallons. By cutting natural gas use by approximately 289 000 m^3 per year and significantly reducing boiler water treatment chemicals, the waste-water recovery program is now saving Kraft more than $100,000 annually.

D.C. Food Processing Inc. installed a new direct-contact water heater to meet the sanitation needs of its plant in Waterloo, Ontario. With an energy efficiency rating of 99.7 percent, the direct-contact heater has led to net savings in energy costs of 19.7 percent. The company has also installed an air make-up system to capture previously vented air from its Cardox freezing process. The new system cuts room air exhaust from 6300 cubic feet per minute to 2800, leading to major savings in energy and equipment costs.

To assist food processors, Natural Resources Canada's Office of Energy Efficiency held two "Dollars to Sense" workshops for the sector in 2001. In Ontario, the Ministry of Agriculture, Food and Rural Affairs held sub-sector-specific workshops, which were very well received.

In 2002, the Food and Beverage Sector Task Force plans to continue its quarterly meetings, develop value-added tools for its association partners and build on past successes by holding customized regional "Dollars to Sense" workshops.

ACHIEVEMENTS

Canada's food processing industry continued to increase its gross output and GDP in 2000/2001, with GDP rising by 2.5 percent to $11.22 billion. Its total energy consumption rose to 98 884 TJ in 2000 compared with 94 113 TJ in 1999, an increase of 5 percent. Over the past 10 years, its total energy consumption increased 15.5 percent, from 85 608 TJ in 1990 to 98 884 TJ in 2000, due largely to a significant increase in electricity consumption.

Although a move toward increased automation in the sector largely explains the 10-year trend, reasons for the year-over-year increase between 1999 and 2000 are not clear. It is likely that a number of factors are involved, including statistical variations due to changes in the sample size, better-quality reports, and industrial changes such as a move toward electricity cogeneration coupled with difficulties in differentiating between power used and power sold back into the grid.

The sector's use of heavy fuel oil also increased, rising 31.3 percent over the past year. This increase is a direct result of large, rapid increases in natural gas rates in 2000 and a move back to heavy fuel oil by food processors seeking to maintain control over production costs. A roll-back in natural gas prices should drive heavy fuel oil consumption back to 1999 levels.

Fortunately, the sector has made long-term progress toward meeting its goal to improve energy efficiency. From 1990 to 2000, food processors improved their collective energy intensity by 3 percent.

CHALLENGES

Following a poll of member companies, the food and beverage sector has established aggressive targets for energy efficiency. For the years 2000 to 2005, the sector anticipates an average reduction in energy use of 2.2 percent per year. From 2006 to 2010, the sector's goal is an average reduction of 1.7 percent per year, for a total of 19.5 percent over the next 10 years.

Electricity deregulation is expected in Ontario in May 2002. This will likely result in a spike in electricity rates and drive the development of new energy efficiency initiatives. These initiatives will most likely centre on people and practices rather than the introduction of new technology.

The membership profile of the Food and Beverage Sector Task Force is diverse and is reflected in the sector's wide range of association partners. The challenge for the task force is to nurture and support each member association's participation and work toward the launch of sub-sector task groups. The sector is progressing toward this goal.

FOUNDRY

PROFILE: *Metal castings are the first step in the value-added manufacturing chain and are utilized in the manufacture of most durable goods. Markets and industries served by foundries include the automotive sector, construction, agriculture, forestry, mining, pulp and paper, heavy industrial machinery and equipment, aircraft and aerospace, plumbing, soil pipe, municipal road castings, defence, railway, petroleum and petrochemical, electric distribution and a myriad of specialty markets. There are approximately 200 foundries in Canada, employing 15 000 people and generating annual sales of more than $2 billion. About 80 percent of the foundry sector's production is exported.*

PERFORMANCE HIGHLIGHTS

- Canada's 200 foundries employ 15 000 people and generate annual sales of more than $2 billion.
- Gamma Foundries Limited replaced two coreless induction-melting furnaces with the latest technology and installed a new energy-efficient water/air heat exchanger for winter heating.
- Crowe Foundry Limited attached a demand monitor to its furnaces to control peak demand and reduce overall energy consumption.
- Power management efforts at Lethbridge Iron Works Company Limited have reduced the company's electricity consumption by 5 percent and cut compressed-air losses in half.
- Foundry benchmarking data are now available, thanks to the creation of a tracking and reporting system based on Statistics Canada protocols.
- The foundry sector has developed an on-site energy audit program to establish cost savings and tangible environmental benefits.

The sector is currently working with the Canadian Industrial Energy End-Use Data and Analysis Centre and the Office of Energy Efficiency of Natural Resources Canada to develop indices and figures.

ACTIONS

Energy efficiency improvement is a critical activity for Canada's foundries. The industry's ongoing efforts are built on a multi-faceted strategy that begins with goal setting and includes investments in operational improvements, monitoring and targeting, energy-efficient processes and technology, and employee training and awareness programs. Throughout the sector, foundries have established energy monitoring and control systems and are reclaiming process heat for reuse in their operations.

Individual foundries continued to take action to advance their energy efficiency programs. Crowe Foundry Limited of Cambridge, Ontario, attached a demand monitor to its furnaces as part of aggressive efforts to control peak demand and reduce overall energy consumption. The company has evaluated lighting throughout its plant and introduced a program whereby lights are turned off when they are not needed. By replacing an old, inefficient water-cooled compressor with a more efficient unit, the company has also reduced its water consumption.

While replacing the firebrick lining in its heat treat furnace with new Pyrobloc efficient insulating modules, Ancast Industries Ltd. of Winnipeg, Manitoba, also improved seals, replaced the furnace's door and lowered the roof. The upgrade has reduced cycle and cool-down times, cut the time between loads, improved oven utilization and reduced natural gas consumption. Ancast also installed a new control system for office heating and plant air make-up units. The new system reuses hot exhaust air for space heating and automatically reduces energy use in non-operating hours, thereby further reducing natural gas use.

Gamma Foundries Limited of Richmond Hill, Ontario, replaced two coreless induction-melting furnaces with units incorporating the latest technology. The company also installed a new energy-efficient water/air heat exchanger to augment the plant's winter plant-heating program. By installing a new sand-reclamation system, Gamma Foundries has reduced the need for sand disposal, thereby cutting disposal costs and its use of diesel fuel. Within the plant, the company continues to improve lighting efficiency through an ongoing program to convert sodium lighting to metal halide lighting.

To combat the doubling of electricity prices due to deregulation, Lethbridge Iron Works Company Limited in Alberta has undertaken a number of power-saving initiatives. Early in the year, the company launched a program to extinguish unnecessary lighting during non-production shifts and to eliminate unneeded lights in warehouse and non-production areas. Schedules for equipment operations have been optimized, thereby minimizing the plant's daily peak electrical loads. As a result, electricity consumption has been reduced by up to 5 percent. Lethbridge Iron Works also introduced an aggressive program to eliminate leaks in its compressed-air system, enabling the foundry to reduce total leakage by more than half. A small, 40-horsepower compressor was installed for use during low-demand non-production hours, saving about 260 000 kWh annually – enough electricity to power 33 homes for a year.

At the sector level, the Canadian Foundry Association (CFA) continues to pursue activities in keeping with its energy efficiency plan. In partnership with Natural Resources Canada's (NRCan's) Office of Energy Efficiency (OEE), the CFA has created an energy efficiency opportunities guidebook and cooperated in the development of "Dollars to Sense" workshops specifically for the foundry sector. Foundry benchmarking data will be available in next year's annual report thanks to the establishment of an appropriate tracking and reporting system for energy and production data based on protocols established by Statistics Canada. The CFA and the OEE are exploring the gathering of energy-benchmarking information in conjunction with the CFA's "Pilot Project on Productivity Improvement," beginning early in 2002.

The foundry sector has also piloted the development of an on-site energy audit program, which combines elements of NRCan's former Mobile Foundry Audit program and the OEE's current Industrial Energy Innovators audit program. The audit process will enable companies to identify and implement improvement projects in energy, water, waste-water, GHG and air emissions, and solid wastes to realize cost savings and tangible environmental benefits.

ACHIEVEMENTS

Motivated by environmental and bottom-line concerns, Canada's foundries continue to implement energy efficiency improvements and reduce GHG emissions. Many companies no longer use GHG-generating fuels such as coal, oil or coke in their operations and have eliminated the use of steam produced by coal-generated electricity.

Escalating oil, natural gas and power costs are leading a growing number of companies to adopt active programs throughout the industry, including the adoption of more efficient equipment, better methods, fuel switching and waste-energy capture programs. These actions are bolstering the sector's efforts to improve its energy efficiency.

CHALLENGES

Driven by the rising cost of energy, Canada's foundries are on an endless search for energy-efficient equipment and methods. To remain competitive, foundries must closely monitor energy consumption and implement programs to improve energy efficiency. These efforts are complicated by the sector's growing business complexity. Many sector companies now go far beyond raw castings to design parts, build tooling, cast prototypes and make, machine and assemble the casting. Often, they are called on to produce completed components or assemblies, ready for the customer's assembly line. Although these additional activities have added to the sector's capabilities, employment and profit, they have also led to increased energy consumption.

The often conflicting needs to respond to customer demand for expanded services, remain price competitive and meet environmental standards are taxing the resources of many foundries and creating a need for new, cost-effective energy efficiency technologies and solutions.

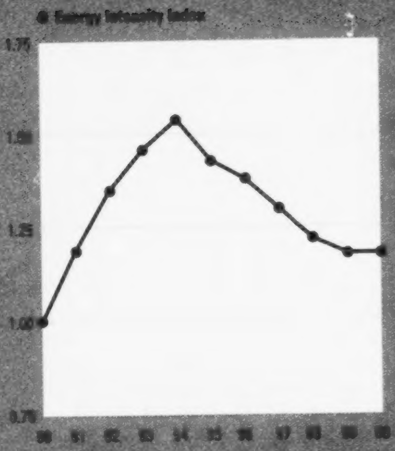
GENERAL MANUFACTURING

PROFILE: *The general manufacturing sector comprises a variety of industries, including leather, clothing, furniture, printing, machinery, construction materials, floor coverings, imaging products, insulation, adhesives and pharmaceuticals. The sector encompasses approximately 2000 small-, medium- and large-sized companies that, combined, consumed 180 422 TJ of energy, or about 7 percent of the total energy consumed by all CIPEC sectors in 2000.*

PERFORMANCE HIGHLIGHTS

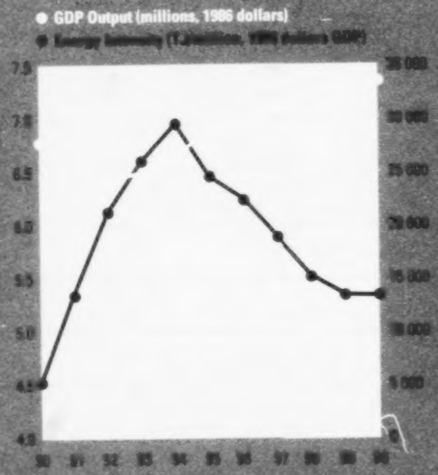
- The approximately 2000 companies included in the general manufacturing sector consumed about 180 422 TJ of energy in 2000.
- Task forces in Alberta and Quebec have broadened CIPEC's reach in western and eastern regions.
- Versacold Corporation is capturing waste heat from its compressors and evaporators and using it to preheat steam process water for Maple Leaf Potatoes.
- Improvements to motor drive, lighting and production process systems have netted International Paper Industries Ltd. a 10-percent improvement in annual energy consumption.
- Owens Corning has announced its "2002 Energy Mission," a worldwide corporate energy strategy that aims to reduce the company's energy consumption by 20 percent by 2003.
- A boiler plant upgrade at Coyle & Greer Awards Canada Ltd. has reduced boiler energy costs by 29 percent.
- Teknion Furniture Systems Inc. has implemented an energy-conservation program as part of its ISO 14001 program.
- Sintra Inc. has made improvements to its stone-crushing unit that have reduced energy consumption per tonne of stone processed.
- Soprema Inc. conducts an active, ongoing environmental awareness program for employees.
- EMCO Limited installed high-efficiency boilers at its plant in La Salle, Quebec, improving the efficiency of its steam plant by 13 percent.

General Manufacturing Sector
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



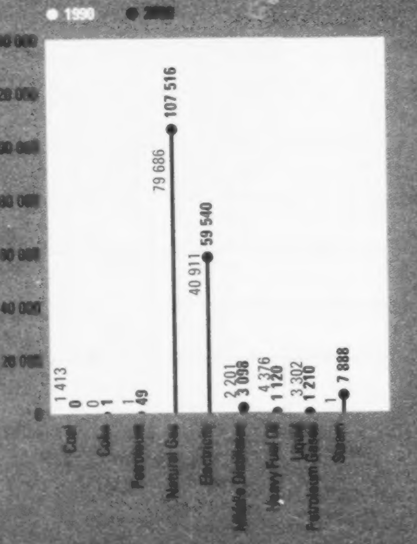
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

General Manufacturing Sector
Energy Intensity and Economic Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

General Manufacturing Sector
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

The General Manufacturing task forces continue to aggressively pursue energy efficiency improvements across the country. In Ontario, the Central Task Force is strengthening its membership with increased participation of industry representatives and associations. In Quebec, the Eastern Task Force has attracted an active membership that includes associations reaching nearly all corners of the province.

The Western Task Force continues to address issues arising from deregulation and fluctuating power costs. Based in Alberta, the group has been working to broaden participation within Alberta and expand its reach into the other western provinces.

Across the country, individual general manufacturing sector members are making important contributions to energy efficiency. For example, at its facility in Lethbridge, Alberta, cold food storage and distribution company Versacold Corporation is capturing waste heat from its compressors and evaporators and using it to preheat steam process water for Maple Leaf Potatoes. The two companies share the same facility. In its first year of operation, the $105,000 project reduced natural gas consumption by 11 percent, saved 13 000 GJ of natural gas and led to reduced electricity consumption. When all energy savings are combined, the payback period for the project is less than one year.

International Paper Industries Ltd. of Surrey, British Columbia, has made improvements to its motor drive, lighting and production process systems, which has netted the company a 10-percent improvement in annual energy consumption. The company expects further gains to come from preventive maintenance programs on its rolling stock, efficiency upgrades to its electrical systems and capital investments in alternate drive systems.

Owens Corning has announced its "2002 Energy Mission," a worldwide corporate energy strategy that aims to reduce the company's energy consumption by 20 percent by 2003. Energy makes up about 15 percent of the company's total cost of operations. Already an active participant in energy efficiency efforts, Owens Corning has recently converted the lift trucks at its facility in Edmonton, Alberta, from propane to natural gas, thereby saving $20,000 per year in energy costs.

Coyle & Greer Awards Canada Ltd. of Mossley, Ontario, has upgraded the boiler plant at its Mossley facility, thereby reducing boiler energy costs by 29 percent. Teknion Furniture Systems Inc. of Toronto, Ontario, has implemented an energy-conservation program as part of its ISO 14001 program for 2002. The company already uses motion sensors to control lighting and automatic thermostats that vary heating based on hours of operation. Teknion is now looking at ways to improve the efficiency of its drying and curing ovens.

The paving company Sintra Inc., headquartered in Montréal, Quebec, has made improvements to its stone-crushing unit that have reduced energy consumption per tonne of stone processed. The company also emphasizes energy efficiency in the selection of engine-powered mobile equipment.

Bituminous membrane manufacturer Soprema Inc. of Drummondville, Quebec, is an ISO 14000 registered company committed to sound environmental practices. The company conducts an active, ongoing environmental awareness program for employees and has recently made improvements to its cooling tower to reduce energy consumption.

EMCO Limited has converted the main dryer on the production line of its plant in Pont-Rouge, Quebec, from steam coil heat to a more efficient direct-fire natural gas system. The company has also installed two new high-efficiency boilers at its plant in La Salle, Quebec, improving the efficiency of its steam plant by 13 percent and reducing CO_2 emissions.

ACHIEVEMENTS

The General Manufacturing task forces continue to make progress in meeting the commitments outlined in their 1999/2000 action plan. The task forces have established and are maintaining ongoing collaborative efforts with manufacturing, technology and energy organizations with an interest in furthering industrial energy conservation and efficiency. Moreover, growing regional task forces in western and eastern Canada are extending CIPEC's reach to manufacturers nationwide. Across the country, the sector continues to pursue and encourage the involvement of other associations and firms and to stimulate the reporting of energy efficiency progress by the sector's Industrial Energy Innovators.

These efforts are paying off as sector companies continue to earn recognition for their efforts toward improved energy efficiency. The latest of these companies is EMCO Limited, an Industrial Energy Innovator, which has been recognized as a Silver Level Champion Reporter by Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.). The award is the second highest level of achievement in VCR Inc.'s Champion Reporting system.

CHALLENGES

The implementation of energy efficiency programs is an uphill battle for many companies in the general manufacturing sector. For less energy intensive companies, the relatively small role that energy plays in overall costs makes it difficult to justify major capital expenditures. Where energy is a larger component of overall costs, many manufacturers, especially smaller ones, lack the knowledge and financial resources to identify and act on energy-saving opportunities. For companies of all sizes, the lack of staff and capital resources to dedicate to energy projects is a significant impediment.

These challenges are exacerbated by wide fluctuations in energy prices, which make it difficult to build a classical business case for investments in energy efficiency. Moreover, as many companies restructure to lower costs and reduce staffing, the competition for resources has pushed energy efficiency improvement programs to the back burner.

Compounding difficulties is the sector's diversity. Covering an extremely broad range of industries comprising companies of all sizes makes it a challenge to develop comprehensive, accurate, sector-wide energy data.

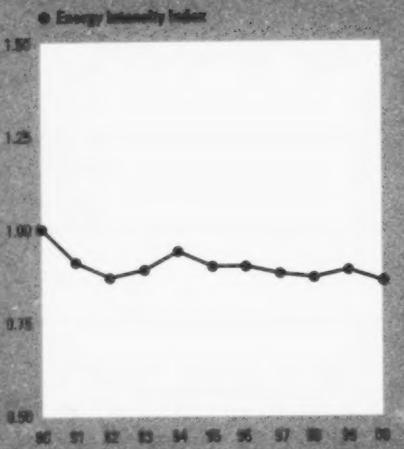
LIME

***PROFILE**: Canada's merchant lime sector supplies essential raw materials for steel production, mining, pulp and paper manufacturing, water treatment, environmental management and other basic industries. Operating 15 facilities and employing more than 700 people, the sector's four companies and their affiliates had a combined lime calcining capacity of 3.13 million tonnes in 2000. Although lime production in 2000 dropped by 0.6 percent compared with 1999, production increased by a total of 28.1 percent compared with 1990.*

PERFORMANCE HIGHLIGHTS

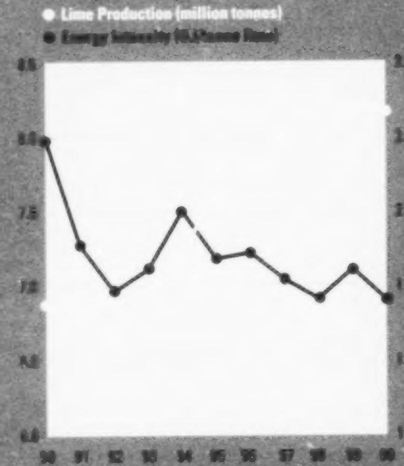
- From 1990 to 2000, the lime sector increased production by 28.1 percent.
- Graymont (NB) Inc. cut the fuel used in its kilns by 440 000 litres per year.
- Graymont Western Canada Inc. plans to improve its energy monitoring and tracking system.
- Beachville Lime Limited introduced a new operating strategy that has led to a reduction in coal, coke and natural gas consumption of 1 528 956 million Btu in 2000 and an additional 592 451 million Btu in 2001.
- While total energy consumption increased by 1604 TJ between 1990 and 2000, the sector's energy intensity index decreased by 13.5 percent.
- Companies representing 98.7 percent of the lime production capacity in Canada's merchant lime sector are now Industrial Energy Innovators.

Lime Sector SIC 3581
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



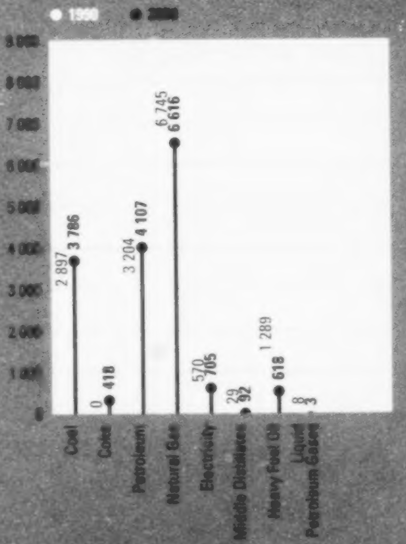
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Lime Sector SIC 3581
Energy Intensity and Physical Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Lime Sector SIC 3581
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

In 2001, the Canadian Lime Institute in conjunction with Natural Resources Canada's Office of Energy Efficiency produced *Energy Efficiency Opportunity Guide in the Lime Industry*. The guide looks at all aspects of lime production and identifies projects and operational measures that can be employed to improve energy efficiency.

Individual companies in the lime sector continue to make significant energy efficiency improvements. For example, through a variety of energy efficiency measures, including the introduction of an environmental management system built on an ISO 14000 model, Graymont (NB) Inc. has reduced the energy needed in its kiln from 105.8 litres of oil per tonne of product to 99.6 litres. This action is saving the company 440 000 litres of oil annually. Other initiatives launched by the company have led to significant reductions in the use of electricity and fuel-powered mobile equipment.

In 2000/2001, Beachville Lime Limited introduced an operating strategy that improves the balance between regional kiln operation efficiencies and client quantity and quality demands. This strategy has enabled the company to rationalize kiln operations, eliminate energy-inefficient kilns and allocate increased loads to more efficient kilns. These actions led to a reduction in coal, coke and natural gas consumption of 1 528 956 million Btu in 2000 and a further 592 451 million Btu in 2001.

Chemical Lime Company of Canada Inc. has set an energy efficiency improvement target of 1 percent per year. The company has installed variable frequency drives and has made improvements to process furnaces, dryers, kilns, compressed-air systems, water systems, motor drives and other systems. Chemical Lime expects to boost kiln efficiency even further by improving its stone-sizing system and will use exhaust CO_2 to treat storm-water run-off.

Graymont Western Canada Inc. has made improvements to its dryers, kilns, motors and lighting systems in its progress toward greater energy efficiency. The company anticipates that annual upgrades to capital equipment along with improvements to its energy monitoring and tracking system will lead to further energy efficiency gains.

ACHIEVEMENTS

Within the merchant lime sector, Industrial Energy Innovators account for 98.7 percent of Canada's production capacity, and companies represented by the Canadian Lime Institute continue to work actively to improve the energy efficiency of their operations.

In 2000, it took 16 350 TJ of energy to produce 2 367 714 tonnes of lime. This compares with 16 935 TJ and 2 381 395 tonnes in 1999, and 14 746 TJ and 1 847 906 tonnes in 1990. Energy consumption per tonne of lime decreased from 7.11 GJ per tonne in 1999 to 6.90 GJ in 2000, a 3-percent improvement. While total energy consumption increased by 1604 TJ between 1990 and 2000, the sector's energy intensity index decreased by 13.5 percent. The sector continues to target continuing improvement at a rate of 0.3 percent to 0.5 percent per year.

About 60 percent of the GHGs emitted by the lime sector result from the calcination or decomposition of limestone. The remaining 40 percent is related to the energy used to prepare limestone for calcination and to convert it into finished products. GHG emissions resulting from the production of lime are offset to some extent by the re-absorption of CO_2 by lime during its life cycle. The National Lime Association estimates that more than 25 percent of the lime produced in Canada and the United States re-absorbs CO_2 either in process or naturally.

CHALLENGES

The production of lime occurs at high temperatures using large quantities of combustion fuel. Natural gas is the principal fuel source, with petroleum, coke and coal making up most of the balance. In an industry heavily dependent on such fuels, rapidly rising fuel prices make energy efficiency a top priority. However, although ongoing refinements continue to be made to existing calcining equipment, substantial capital investments in new, more efficient kiln installations are needed in order to make major gains. Lime producers continue to be challenged to find the capital necessary for such investments.

Producers are also challenged to balance energy efficiency with quality. Fuel switching and high-efficiency large kiln technology may reduce energy requirements, but they can also interfere with product quality, a significant concern for some of the sector's largest customers.

MINING

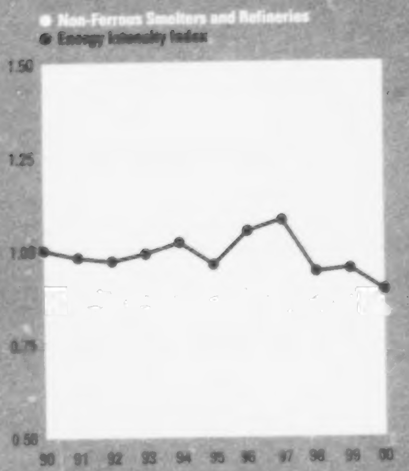
PROFILE: *Canada's minerals and metals industry produces 60 different mineral commodities. In January 2001, there were 71 metal mines and 26 non-ferrous metal smelters and refineries (excluding aluminum) located across Canada. The mining and minerals processing industry directly employs 401 000 people and contributed $28 billion to Canada's GDP in 2000 – 3.6 percent of the national total.*

Canada is one of the world's largest mineral exporters, with 77 percent of its production – valued at $49 billion – destined for foreign markets. This represents 13 percent of total domestic exports, or one in every eight export dollars. Despite an overall decline in mineral prices in recent years, mineral and metal exports increased by 70 percent between 1993 and 2000.

PERFORMANCE HIGHLIGHTS

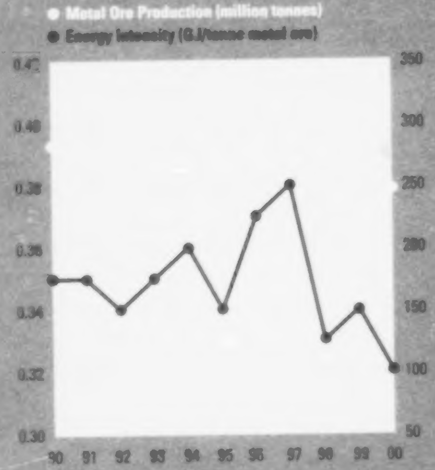
- Canada is one of the world's largest mineral exporters, with 77 percent of its production – valued at $49 billion – destined for foreign markets.
- To date, Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) has awarded Gold Level Champion Reporter status to five companies that are members of the Mining Association of Canada (MAC).
- To enable companies to take basic inventory of GHGs, estimate emissions changes for specific projects and report on emissions, MAC has released its *Strategic Planning and Action on Climate Change – A Guide for Canadian Mining Companies* on CD-ROM.
- MAC's Task Force on Energy hosted its first annual energy efficiency conference in April 2001.
- Nine MAC members are currently completing an open-pit energy-benchmarking study.
- At its Raglan facility in the Nunavik territory of northern Quebec, Falconbridge Limited is employing an innovative heat recovery system to convert waste heat from its diesel generating system into usable energy.
- A pilot energy breakthrough program at Inco Limited has generated more than 450 energy-saving ideas from the company's plant personnel.

Mining Sector – Metal Mining SIC 61 and Non-Ferrous Metal Smelters and Refineries SIC 2959 Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



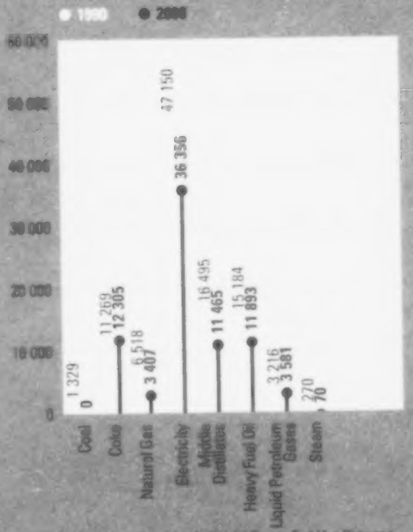
Data source for SIC 2959: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *An Action Plan for Reducing Greenhouse Gas Emissions*, Mining Association of Canada, October 2001

Mining Sector SIC 61 Energy Intensity and Physical Output (1990–2000)



Data source for SIC 61: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University

Metal Mining SIC 61 Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University

ACTIONS

Members of the Mining Association of Canada (MAC) are firmly committed to participating in a solution to climate change and have made energy efficiency a priority. As part of their commitment to GHG reduction, 16 of MAC's 30 members, representing the majority of energy consumed in the mining sector, participate in Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.). To date, VCR Inc. has awarded Gold Level Champion Reporter status to five MAC member companies (Falconbridge Limited, Inco Limited, Noranda Inc., Suncor Energy Inc. – Oil Sands, and Syncrude Canada Ltd.); Silver Level Champion Reporter status to Koch Canada, L.P.; Newmont Canada Limited; and Teck Cominco Limited; and Bronze Level Champion Reporter status to BHP Billiton Diamonds Inc. In 2001, MAC became one of three associations awarded VCR Inc.'s Gold Level Champion Reporter status.

MAC has issued *Strategic Planning and Action on Climate Change – A Guide for Canadian Mining Companies*. This guide, prepared with assistance from the Pembina Institute, Stratos and Natural Resources Canada's Office of Energy Efficiency, is a pivotal tool to help the mining industry devise climate change strategies that support long-term GHG-reduction efforts.

In June 2001, the guide was released on CD-ROM. This format, with its electronic template for inventorying, measuring and reporting on climate change actions, will enable companies to take basic inventory of GHGs, estimate emissions changes for specific projects and report on emissions.

To help the industry align its strategic and corporate actions on climate change, MAC's Task Force on Energy hosted its first annual energy efficiency conference in April 2001. At the conference, energy managers from across Canada identified eight requirements for an effective energy efficiency program, including management commitment, measurement and control, communications, alternative energy development, new technology, operational optimization and government policy.

MAC's Task Force on Energy is committed to fostering new concepts in energy efficiency. For example, in addition to the completion of an underground bulk mining energy-benchmarking study, nine MAC members are currently completing an open-pit energy-benchmarking study. Within the industry, individual companies are seizing opportunities to improve energy efficiency.

For example, at its remote Raglan facility in northern Quebec, Falconbridge Limited is employing an innovative heat recovery system to convert waste heat from its diesel generating system into usable energy. This technology bypasses the need to generate an additional 250 GW of electricity and enables Raglan to cut its annual emissions of CO_2 equivalent by 70 kilotonnes. Thanks to its heat recovery program, Raglan's power and heating system energy conversion efficiency is 65 percent, and its overall cost per kWh is $0.06, making the Falconbridge facility one of the world's most energy-efficient sub-arctic mining facilities.

Inco Limited has a long-standing commitment to energy efficiency and GHG-emissions reduction. Now, a pilot energy breakthrough program has uncovered additional opportunities for energy efficiency. By setting aggressive targets, developing effective metrics and focusing on end-user behaviour, the pilot project has generated more than 450 energy-saving ideas from the company's plant personnel. In the first three months, natural gas consumption fell 25 percent below budget, and electricity use dropped 10 percent below budget. So far, the pilot project has generated sustainable annual energy efficiency gains of $3.5 million.

ACHIEVEMENTS

The metal mining industry's energy mix is heavily weighted toward electricity (46 percent), followed by heavy fuel oil (15 percent) and middle distillates (14.5 percent). In 2000, total energy used in metal mining was 79 080 TJ. Over the period 1990–2000, energy consumption in metal mining decreased by 22 percent, while energy intensity, or energy per unit of metal concentrate, improved by 9 percent.

The non-ferrous metal smelting and refining industry (excluding aluminum and magnesium) also has an energy mix weighted toward electricity (49.4 percent), followed by natural gas (26.1 percent) and coal (12.6 percent). In 2000, total energy use was 86 225 TJ. While the non-ferrous sector increased its energy consumption by 5 percent over the period 1990–2000, energy intensity – or energy per unit of refinery output – plus matte export improved by 11.9 percent (1990–1999).

CHALLENGES

Energy costs for Canada's mining sector represent a significant component of the total costs of operations, making energy efficiency an industry priority. To meet this challenge, the industry has employed new technology and results-based energy audits to boost its energy efficiency, reduce emissions and improve competitiveness. Fortunately, many financially attractive opportunities still exist for improving energy efficiency and reducing costs. However, the limits of technology and the net cost of further reducing GHG emissions are significant barriers.

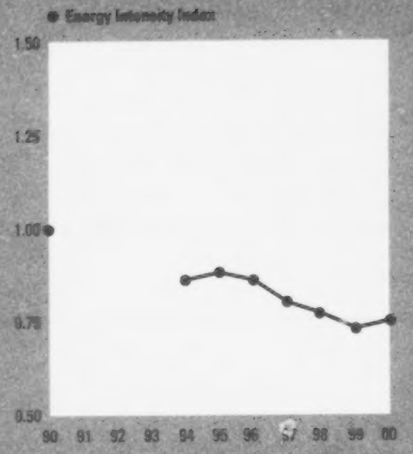
OIL SANDS

PROFILE: *Canada's oil sands sector includes two plants in northern Alberta and one heavy oil upgrader in Saskatchewan. Together, these facilities produce more than 500 000 barrels of crude oil per day for markets in Canada and the United States. The sector is a major employer and a significant contributor to Canada's GDP.*

PERFORMANCE HIGHLIGHTS

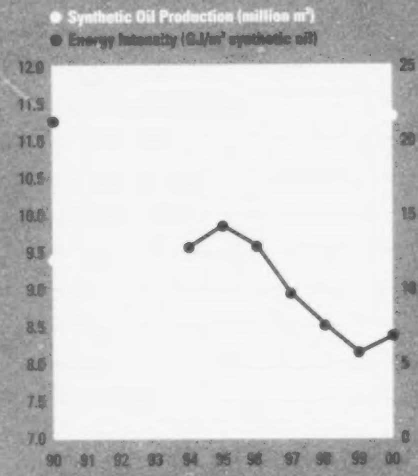
- The oil sands sector is committed to ongoing improvements in energy efficiency through a combination of operational excellence and technological innovation.
- Husky Energy Inc.'s cogeneration project at its site in Lloydminster, Saskatchewan, is reducing GHG emissions by 168 000 tonnes per year on a CO_2-equivalent basis.
- Suncor Energy Inc.'s oil sands 2000 CO_2-equivalent emissions per unit of production were 30.7 percent below the benchmark 1990 level.
- From 1988 to the end of 2000, Syncrude Canada Ltd. cut CO_2 emissions per barrel of oil produced by 27 percent.
- The upcoming Athabasca Oil Sands Project is committed to a best-practices approach to environmental management.
- In 2000, energy consumed per unit of production was 8.36 GJ/m^3, a total improvement of 25 percent since 1990.

Oil Sands Sector SIC 712
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



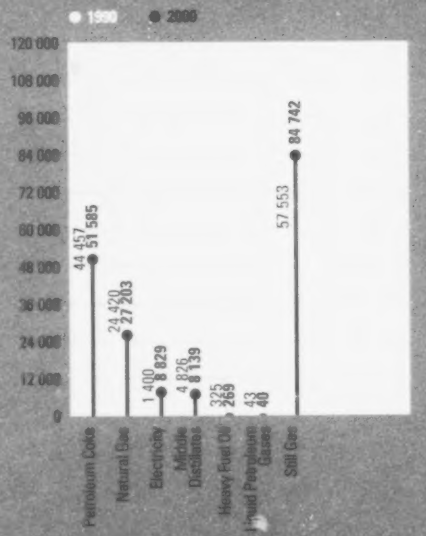
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Oil Sands Sector SIC 712
Energy Intensity and Physical Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Oil Sands Sector SIC 712
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

The oil sands sector continues to make ongoing improvements in energy efficiency through a combination of operational excellence and technological innovation. Plants are improving the reliability of their operations and introducing programs to recover waste heat and boost yields through more efficient processing. Other gains are coming from the introduction of new technologies in the mining and extraction stages.

Husky Energy Inc. is now drawing power from the Meridian Cogeneration Project at its heavy oil upgrader site in Lloydminster, Saskatchewan. The project is a joint effort with TransAlta Energy Corporation, the cogeneration plant's operator. Steam transferred from the plant has enabled Husky to reduce the heat in some of its boilers, leading to an estimated emissions-reduction equivalent of 168 000 tonnes of CO_2 per year. A further 14 000-tonne reduction in CO_2 equivalent was achieved when Husky optimized process controls on its upgrader power boilers.

Suncor Energy Inc. – Oil Sands has been engaged in the construction of a four-year, $3.4-billion expansion called Project Millennium that will see oil sands production nearly double to 225 000 barrels of oil per day by the end of 2001. Suncor is also exploring new technologies that could significantly reduce emissions from oil sands production. Following evaluation, the company will pursue technologies that show major environmental and economic potential for the next stage of development. Technologies being evaluated include warm- and cold-water extraction, thickening and clarifying of tailings streams, coke gasification, solvent recovery and CO_2 sequestration disposal methods. Suncor's oil sands 2000 CO_2-equivalent emissions per unit of production were 30.7 percent below the benchmark 1990 level, and the company projects that efficiency initiatives now underway will lead to a further drop to 0.574 tonnes of CO_2 equivalent per unit of production by 2005.

"Syncrude 21," Syncrude Canada Ltd.'s 11-year strategic capital investment program begun in 1997, is upgrading oil sands operations and improving energy efficiency. The first stage of this four-stage program, which covers the company's new North Mine and several de-bottleneck projects in its upgrader, has been completed, and the new facilities are in operation. The second stage, which includes the first train of the company's Aurora Project and further de-bottlenecking of bitumen processing units, was put into operation in the second quarter of 2000. Syncrude 21 and predecessor activities have had a significant impact on the company's energy efficiency and, subsequently, on GHG emissions. From 1988 to the end of 2000, Syncrude cut CO_2 emissions per barrel of oil produced by 27 percent. The company estimates that by 2010 the total reduction will improve to 40 percent.

Syncrude employees have also pledged to take individual action to improve energy efficiency. More than 600 employees have agreed to reduce their GHG emissions by an average of 2860 kg per year under the Energy Council of Canada's Action By Canadians on Climate Change (ABC) Program. These pledges represent a 14-percent decrease in average household GHG emissions, which is substantially higher than the program's 2000-kg minimum requirement.

The Athabasca Oil Sands Project, scheduled to begin operations in late 2002, is committed to a "best practices" approach to environmental management. The project plans to build on the experience of existing oil sands operators and implement new technologies to increase environmental performance in all of its new facilities. Energy efficiency is a priority for the project, and the Athabasca consortium plans to use gas-fired cogeneration at both of its facilities.

ACHIEVEMENTS

In 2000, the oil sands sector continued to make steady progress toward energy efficiency, but due to an unusual number of operational upsets, the energy intensity was slightly higher than the previous year. Energy consumed per unit of production was 8.36 GJ/m^3, which is 3 percent higher than in 1999. While total annual production rose 81 percent since 1990, energy use rose only 36 percent. In 2000, energy consumption totalled 180 809 TJ. Energy intensity showed a total improvement of 25 percent since 1990. This compares favourably with the sector's target of a 1-percent minimum average improvement in energy efficiency per unit of production.

Oil sands industry members continue to emphasize energy efficiency and are constantly pursuing ways to minimize the impact of their operations on the environment. Their commitment is reflected in their efforts to reduce the use of coke by switching to natural gas, resulting in a significant reduction in GHG emissions.

CHALLENGES

The oil sands sector's challenges are mainly technological and financial. Companies operating in this sector must continue to combine investment in innovative technologies with operational excellence to reduce the energy consumed in production. Better, less energy intensive extraction methods must be developed and implemented, and material-handling systems must be modified to more efficiently accommodate increasing production loads. These activities are both time-consuming and expensive. The long lead times and substantial investments required to introduce enhancements continue to force difficult choices on the industry and limit the sector's progress toward greater energy efficiency.

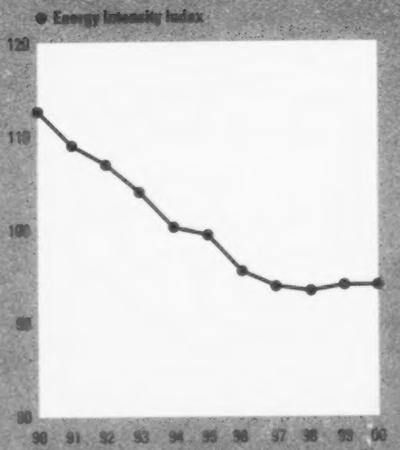
PETROLEUM PRODUCTS

***PROFILE:** Canada's petroleum products sector markets gasoline, diesel, heating oil, jet fuels, lubricating oil, grease, food-grade white oils, asphalts and aromatic hydrocarbons through a network of more than 15 000 wholesale and retail outlets nationwide. Operating 21 oil refineries across the country, the industry provides direct employment for 100 000 Canadians and generates an estimated 100 000 indirect jobs.*

PERFORMANCE HIGHLIGHTS

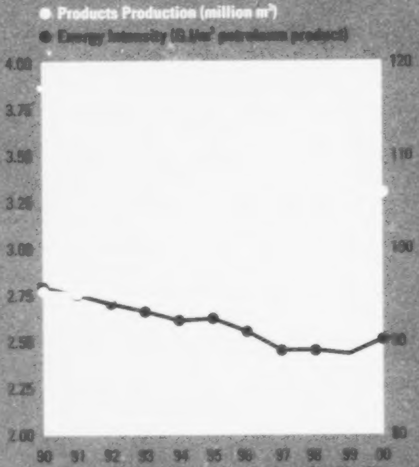
- The industry operates 21 oil refineries across the country and provides 100 000 direct jobs.
- Ultramar Ltd. recorded its best CO_2 emissions intensity results in 10 years – an improvement of 12 percent compared with 1990.
- Petro-Canada implemented projects in 2000 that cut more than 45 000 tonnes from the company's annual GHG emissions and saved more than 800 000 GJ of energy.
- Imperial Oil Limited launched its Global Energy Management System with an end-to-end assessment of energy usage at the company's refinery in Strathcona, Alberta.
- Shell Canada Products Limited's refinery in Scotford, Alberta, focused on reducing the load on hydrocracker process heaters in 2000.
- Suncor Energy Inc. plans to invest $100 million in alternative and renewable energy over the period 2000–2005.
- In 2000, the sector's energy intensity index stood at 94.0, 16.6 percent better than in 1990.

Petroleum Products Sector SIC 3611
Solomon Energy Intensity Index (1990–2000)
Base Year 1990 (112.7)



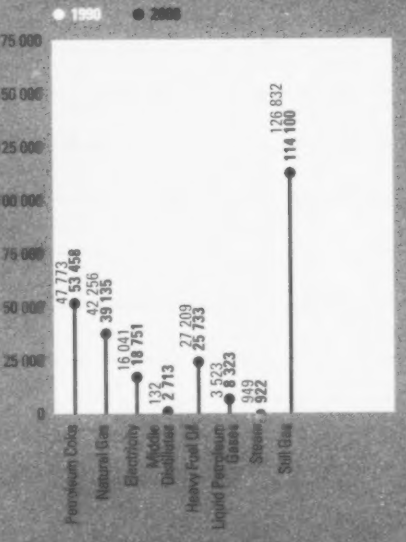
Data source: *Review of Energy Consumption in Canadian Oil Refineries and Upgraders: 1990 to 2000.* Prepared for the Canadian Petroleum Products Institute (CPPI) and the Canadian Industry Program for Energy Conservation (CIPEC) by John Nyboer. Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), November 2001, Simon Fraser University.

Petroleum Products Sector SIC 3611
Energy Intensity and Physical Output (1990–2000)



Data source: *Review of Energy Consumption in Canadian Oil Refineries and Upgraders: 1990 to 2000.* Prepared for the Canadian Petroleum Products Institute (CPPI) and the Canadian Industry Program for Energy Conservation (CIPEC) by John Nyboer. Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), November 2001, Simon Fraser University.

Petroleum Products Sector SIC 3611
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: *Review of Energy Consumption in Canadian Oil Refineries and Upgraders: 1990 to 2000.* Prepared for the Canadian Petroleum Products Institute (CPPI) and the Canadian Industry Program for Energy Conservation (CIPEC) by John Nyboer. Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), November 2001, Simon Fraser University.

ACTIONS

Member refineries of the Canadian Petroleum Products Institute are committed to improve the refining sector's energy intensity index by 1 percent per year through to 2005. To meet this goal, individual Canadian refiners continue to invest in capital projects and make improvements to their operations that are enhancing energy efficiency.

For example, at its refinery in Saint-Romuald, Quebec, in 2000, Ultramar Ltd. replaced defective steam traps, reduced flare losses, improved crude preheat train performance, modified a steam generator and distillate air-cooled exchanger, insulated steam-heated bunker tanks, steam pipes and steam stations, and made capital investments designed to improve energy efficiency. As a result of these activities and its ongoing focus on energy efficiency, Ultramar recorded its best CO_2 emissions intensity results in 10 years – an improvement of 12 percent in 2000 compared with 1990.

Along with its parent and sister companies, Imperial Oil Limited launched its Global Energy Management System (GEMS) with an end-to-end assessment of energy usage at the company's refinery in Strathcona, Alberta. Refinery staff spent some six months compiling data on energy usage in every function, process and operation in the plant. A team of about 20, including experts from within the ExxonMobil refining, research and engineering networks along with outside consultants, then spent two months on-site assessing energy efficiency performance and preparing recommendations for improvement based on global best practices. The GEMS assessment resulted in a comprehensive list of energy-saving ideas along with implementation recommendations, cost estimates and resource requirements. The company will undertake a similar assessment at its refinery in Nanticoke, Ontario, in 2002.

Petro-Canada implemented projects in 2000 that cut more than 45 000 tonnes from the company's annual GHG emissions and saved more than 800 000 GJ of energy. The company estimates that emissions reductions and energy efficiency projects proposed for implementation between 2001 and 2004 will result in additional annual reductions of 1 999 282 GJ of energy and 106 284 tonnes of CO_2 equivalent. Since 1990, the company's actions have reduced annual GHG emissions by more than 1.3 million tonnes.

In 2001, in conjunction with Enbridge Pipelines Inc., Suncor Energy Inc. began construction of the SunBridge Wind Power Project in Gull Lake, Saskatchewan. This $20-million project is expected to generate 11 MW of electricity from 17 wind turbines for distribution through the Saskatchewan power grid. Suncor plans to invest $100 million in alternative and renewable energy over the period 2000–2005. Potential projects include research, development and investment in the production of fuels from biomass, the conversion of municipal solid waste to energy through recovery of methane from landfills, and opportunities in solar and wind power. In 2000, Suncor's GHG-emissions intensity (emissions per unit of production) was 16 percent lower than 1990 levels.

Shell Canada Products Limited's refinery in Scotford, Alberta, focused on reducing the load on hydrocracker process heaters in 2000. Staff examined ways to change the temperature profile of the hydrocracker reactors to reduce the energy required to reheat the process. The refinery introduced a modified temperature profile that reduced the load on the hydrocracker heaters by 15 percent during a trial period. Over the year, this energy reduction could result in savings in excess of $1 million and have a positive impact on GHG emissions. Shell continues to evaluate the optimum application of this technique.

ACHIEVEMENTS

Production of petroleum products and energy intensity increased in 2000. Compared with 1999, production rose by 2.7 percent, while energy intensity increased by 3.5 percent to 2.51 GJ/m^3.

Energy consumption increased by 16 154 TJ, or 6.5 percent, in 2000 compared with the previous year. Since the 1990 base year, the sector's total energy consumption has decreased by 0.04 percent to 266 177 TJ. In 2000, the sector's energy intensity index stood at 94.0, the same as in 1999 and 16.6 percent better than in 1990.

CHALLENGES

Economic uncertainty, fluctuating crude costs and unpredictable international events are making ongoing energy efficiency improvements more challenging for the petroleum products sector. Since higher-capacity utilization improves refinery efficiency, thereby lowering the energy required per unit of output, refiners will be challenged to maintain production at optimum levels in a period of unpredictable demand. In 2000, capacity utilization was 92.0 percent, compared with 90.2 percent in 1999.

The industry will be required to reduce sulphur levels in gasoline and diesel fuels. Meeting increasingly stringent content standards requires refineries to employ more energy intensive methods and processes, which makes it more difficult and expensive to reduce CO_2 emissions. New energy efficiency concepts will be needed for the industry to maintain its trend of continuous improvement.

PULP AND PAPER

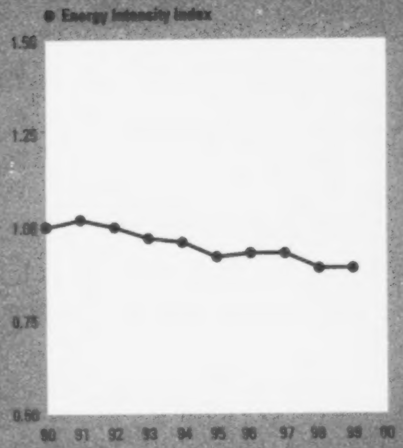
PROFILE: *Pulp and paper, a key component of the forest products industry, is a major contributor to Canada's economy. Besides pulp, the sector includes the newsprint, paperboard, building board and other paper sub-sectors.*

PERFORMANCE HIGHLIGHTS

- Howe Sound Pulp and Paper Limited Partnership has reduced its overall GHG emissions by 12.7 percent since 1990.
- Stora Enso North America, Port Hawkesbury Mill, plans actions that will reduce energy use by 10 percent by 2005.
- Nexfor Inc. has reduced its CO_2-equivalent emissions by 30 percent since 1990.
- Weldwood of Canada Limited has reduced its direct GHG emissions per tonne of output by 30.4 percent since 1990.
- Canfor Corporation expects that projects underway or planned will reduce its 2005 emissions by 10 to 15 percent compared with 1990.
- Alberta-Pacific Forest Industries Inc.'s carbon sink poplar plantations will sequester 561 029 tonnes of CO_2 per year by 2024.

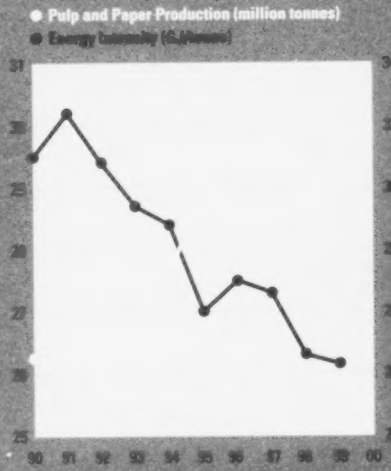
available at time of printing.

Pulp and Paper Sector SIC 271
Energy Intensity Index (1990–1999) Base Year 1990 (1.00)



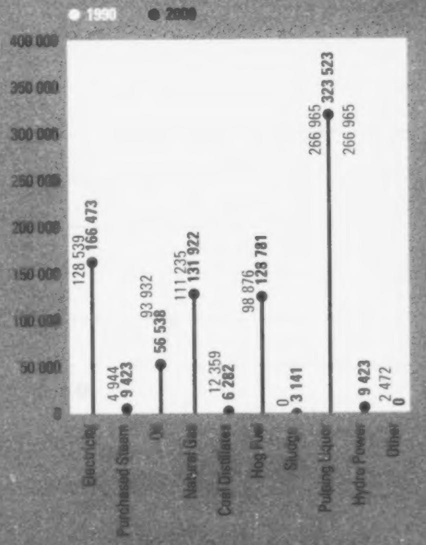
Data source: Forest Products Association of Canada (formerly the Canadian Pulp and Paper Association), *Energy Monitoring Report*, December 12, 2000.

Pulp and Paper Sector SIC 271
Energy Intensity and Physical Output (1990–1999)



Data source: Forest Products Association of Canada (formerly the Canadian Pulp and Paper Association), *Energy Monitoring Report*, December 12, 2000.

Pulp and Paper Sector SIC 271
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Forest Products Association of Canada (formerly the Canadian Pulp and Paper Association), *Energy Monitoring Report*, December 12, 2000.

ACTIONS

Pulp and paper companies continue to improve energy intensity and implement programs to reduce the use of fossil fuels. Following are some examples.

Since 1990, Howe Sound Pulp and Paper Limited Partnership of British Columbia has taken a number of measures to mitigate GHG emissions, including the substitution of natural gas for Bunker C oil, the substitution of wood residues for natural gas, and a variety of process improvements to improve heat and electrical energy efficiency. While these measures have been somewhat offset by production increases, the company has still managed to reduce its overall GHG emissions by 12.7 percent in 2000 relative to the 1990 baseline.

Thanks to the recent availability of natural gas, Stora Enso North America, Port Hawkesbury Mill, of Nova Scotia expects to reduce its CO_2 emissions by 32 percent per tonne of output compared with 1990 levels. The company has also taken measures to cut electricity consumption and plans actions that will combine to reduce energy use by 10 percent by 2005.

Nexfor Inc. has reduced its CO_2-equivalent emissions by 30 percent since 1990 through a combination of energy efficiency projects and the replacement of fossil fuels with biomass energy sources.

Weldwood of Canada Limited has reduced its total GHG emissions by 4.1 percent since 1990, with further reductions forecast for 2001. Although total product output from all company operations, including new acquisitions, has increased 39.0 percent since 1990, overall direct GHG emissions per tonne of output declined by 30.4 percent by the end of 2000.

The substitution of sawmill wood residue biomass energy for fossil fuels, the introduction of electricity cogeneration and other actions taken by Canfor Corporation have reduced the company's GHG emissions by 4.3 percent between 1990 and 2000. The company estimates that projects underway or planned will reduce its emissions in 2005 by 10 to 15 percent compared with 1990.

Alberta-Pacific Forest Industries Inc. is undertaking projects that will significantly impact its GHG emissions. The company plans to sell approximately 6 MW of power annually to the Power Pool of Alberta, indirectly reducing GHG emissions by 46 384 tonnes of CO_2 equivalent per year in the Alberta grid by replacing fossil-fuel-generated power. In addition, Alberta-Pacific Forest Industries has begun creating a forest carbon sink by planting hybrid poplars on agricultural land near its mill. By 2024 the poplar plantations will cover more than 23 600 hectares and sequester 561 029 tonnes of CO_2 per year.

Spruce Falls Inc., a Tembec Inc. company, reports that although its overall energy consumption has risen since 1990 due largely to increased production, the energy used per unit of output has decreased significantly. The company estimates that energy consumed per tonne of product in 2001 was nearly 11 percent below 1990 levels, with a further 4.8-percent decrease expected by 2005. GHG emissions for the same period declined an impressive 62 percent.

The Forest Engineering Research Institute of Canada (FERIC) has adapted Natural Resources Canada's FleetSmart program to create a driver training package that meets the specific needs of the forestry trucking industry. The program, called SmartDriver for Forestry Trucks, was developed in consultation with truckers and the forest industry and is designed to reduce fuel consumption through driver education. The program is available on an interactive, self-directed CD-ROM or as a classroom program delivered by trainers.

FERIC is also working with Tembec Inc. in a partnership called "star trucks." This program integrates the use of innovative materials with cutting-edge technologies and better-designed vehicles to increase vehicle payloads. The "star trucks" initiative has already achieved payload increases of 10 percent, leading to subsequent improvements in energy efficiency.

ACHIEVEMENTS

Over the past decade, the pulp and paper industry has made steady progress toward improving its energy efficiency. Energy data for the year 2000 is not yet available. For the period 1990–1999, the pulp and paper industry improved its energy consumption per tonne of output by 11.2 percent. The achievement is consistent with the industry's commitment of a 1-percent improvement in energy efficiency per year from 1990 to 2000. The sector decreased its total energy consumption per tonne of pulp and paper from 29.5 GJ in 1990 to 26.2 GJ in 1999. Over the same period, the consumption of fossil fuel and electricity (excluding biomass) decreased from 14.2 GJ to 11.8 GJ. The portion of total energy supplied by biomass increased from 50.0 percent in 1990 to 54.0 percent in 1999.

Thanks to an ongoing switch to biomass fuel sources, the pulp and paper industry is reducing its use of less environment-friendly fossil fuel sources, despite growing production. The use of biomass, including wood waste, sludge and pulping liquor, has risen by 23 percent, from 378 200 TJ in 1990 to 464 868 TJ in 1999. Over the same period, the use of heavy fuel oil has been reduced by 39.8 percent. As a result, when biomass energy is excluded, it took 16.9 percent less energy to produce a tonne of pulp and paper in 1999 than it did in 1990. When biomass energy is included, the improvement is 11.2 percent.

CHALLENGES

Fuel switching, especially from fossil fuels to biomass fuels, promises to help the sector achieve additional reductions in energy intensity. However, the availability of wood residues (such as bark, sawdust and wood shavings) is limited in many areas, making transportation costs a significant barrier to greater use of residue surpluses in some parts of Canada. Moreover, production curtailments have led to restrictions on capital spending, creating a serious challenge for companies that are seeking to further improve energy efficiency and reduce GHG emissions.

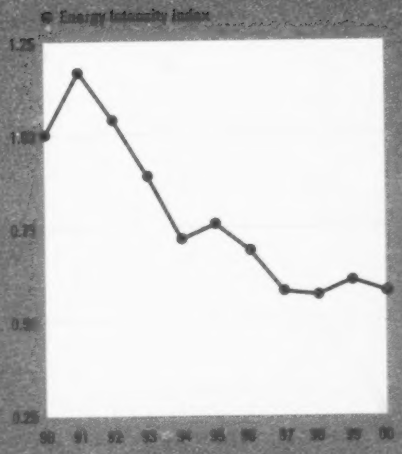
RUBBER

PROFILE: *The rubber products sector comprises establishments that are primarily engaged in manufacturing tires and tubes, automotive parts, rubber hoses and belting, mechanical rubber goods and a wide variety of other products such as rubber and plastic weatherstripping, pressure-sensitive tape, rubber gloves, rubber mats, rubber household products and tire-retreading materials. To meet demand for its products, the rubber products industry employs just over 26 000 people in some 240 facilities nationwide, providing a total payroll of more than $700 million annually.*

PERFORMANCE HIGHLIGHTS

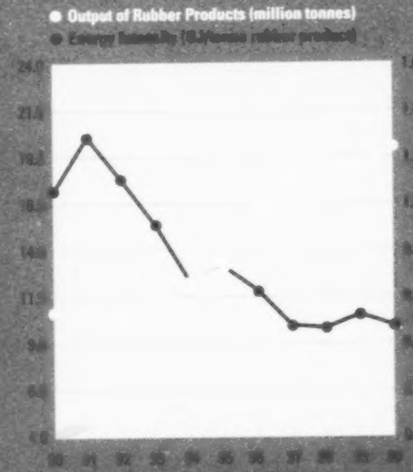
- The rubber products industry employs just over 26 000 people in some 240 facilities nationwide.
- While the total manufacturing industry grew at only 3.0 percent between 1983 and 1987, the rubber industry grew 6.46 percent, the highest average annual growth rate of any industrial sector.
- Twelve tire companies are contributing more than $450,000 to support an energy-saving education program on tires.
- The tire industry is promoting energy-saving wide-base tires for trucking, which can save up to 5 percent in energy consumption.
- Mark IV Automotive Canada Inc. has saved more than 25 percent in annual fuel costs by installing a unique energy-reclaim system.
- Despite the increase in energy consumption demanded by increased production and improved air-emissions quality standards, the sector continues to reduce its energy intensity.

Rubber Sector SIC 15
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



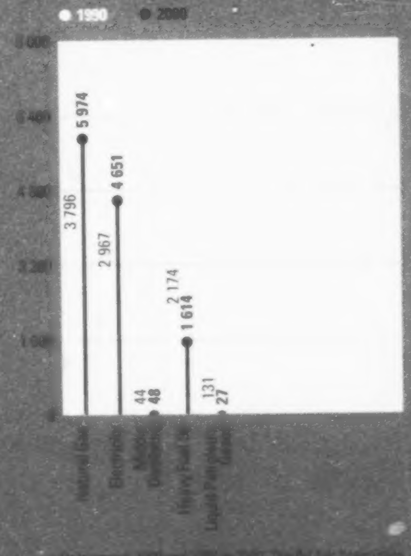
Data source: 1990 and 1996 to 2000, The Rubber Association of Canada (RAC), 2002. Years 1991 to 1995, RAC, 2000.

Rubber Sector SIC 15
Energy Intensity and Physical Output (1990–2000)



Data source: 1990 and 1995 to 2000, The Rubber Association of Canada (RAC), 2002; 1991 to 1995, RAC, 2000.

Rubber Sector SIC 15
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: 1990 and 1996 to 2000, The Rubber Association of Canada (RAC), 2002; 1991 to 1995, RAC, 2000.

ACTIONS

The rubber industry undertook several initiatives in 2000/2001 that are contributing to reduced energy usage. For example, the 12 tire-company members of The Rubber Association of Canada (RAC) agreed to contribute more than $450,000 to support a major consumer education program on tires that will be designed to encourage drivers to save energy by keeping tires properly inflated. Studies show that more than 50 percent of passenger vehicles on the road have at least one tire that is under-inflated by 3 psi or more, contributing to tire failure and a major drain on fuel economy. Properly inflated tires can improve fuel efficiency by up to 5 percent.

The tire industry in Canada is also promoting a new product for the commercial trucking industry, called wide-base tires. With wide-base tires, fewer tires are needed, thereby reducing energy-wasting sidewall friction. As a result, fuel economy is improved by approximately 5 percent, a significant benefit to trucking fleets and to the environment. So far, only Ontario and Quebec have up-to-date trucking regulations that allow these tires, and the RAC and its member companies will continue to educate provincial regulators on their merits.

Individual RAC member firms have also taken action to improve energy efficiency. For example, Mark IV Automotive Canada Inc. has saved more than 25 percent in annual fuel costs by installing a unique energy-reclaim system. The system captures steam and condensate that was previously vented and discharged from the company's vulcanizing process. The company installed new, oversized under-floor vent lines to allow steam to expand and drop in pressure. Vented steam is collected in a flash vessel and transferred to a high-efficiency plate exchanger where boiler feed-water picks up heat from the waste steam. In addition, hot condensate from the vulcanizing process is mixed with make-up water, thereby reclaiming additional heat. The system design has enabled savings of more than 25 percent in natural gas consumption, making it eligible for research and development reimbursements.

ACHIEVEMENTS

The rubber industry's energy performance in 2000/2001 was encouraging. Although production levels of finished product were up 8.1 percent, natural gas consumption rose only 4.6 percent, and electricity consumption dropped 2.4 percent. These numbers indicate a continued improvement in energy usage per unit of output; 48.5 percent of the industry's energy requirements are filled by natural gas, 37.8 percent by electricity and nearly all of the rest by heavy fuel oil.

Based on data collected by the RAC for 2000, total production of the rubber products sector was 1 245 178 tonnes, with a value of approximately $5.48 billion, up from 531 961 tonnes and $2.60 billion in 1990. The majority of the total value of shipments were exports, with more than 95 percent of these going to the United States.

According to Industry Canada's March 2001 report, *Performance of Canada's Manufacturing Sector*, while the total manufacturing industry grew by only 3.0 percent between 1983 and 1987, the rubber industry grew 6.46 percent, the highest average annual growth rate of any industrial sector. Over the same period, energy costs per dollar of output for the rubber sector plunged by more than half (from 2.3 percent to 1.1 percent), while costs for total manufacturing declined by less than a quarter (from 2.9 percent to 2.1 percent).

In absolute terms, energy consumption for the rubber products industry increased between 1990 and 2000, rising from 9115 TJ in 1990 to 12 314 TJ in 2000. However, the sector's gross output increased at a higher rate, leading to a decline in energy intensity over the same period.

CHALLENGES

The rubber industry has become increasingly energy efficient since 1990, a trend aided by pressures to reduce production costs and by the impact of consolidation and industry rationalization. However, although new capital investment could provide opportunities to lower the energy intensity for the sector, such investment may not be made in Canada. Canadian policy-makers must remain cognizant that, within a globally rationalized industry, investment decisions are generally made after a rigid corporate capital pool analysis of all competing international production jurisdictions. Personal and business taxation play a significant role in the decision-making process.

Moreover, government legislation will add significant cost to rubber tire production. For example, in the United States – the destination for most of the Canadian industry's production – recent legislation significantly alters the way tires are marked and has added enormous expense to mould costs. Canadian regulations are harmonized with those in the United States, leading to similar and parallel action on the part of Transport Canada. At a time when the industry faces the pressures of shareholder expectations, market uncertainty, increased energy and raw-material costs and declining margins, it will also face significant additional regulatory overhead.

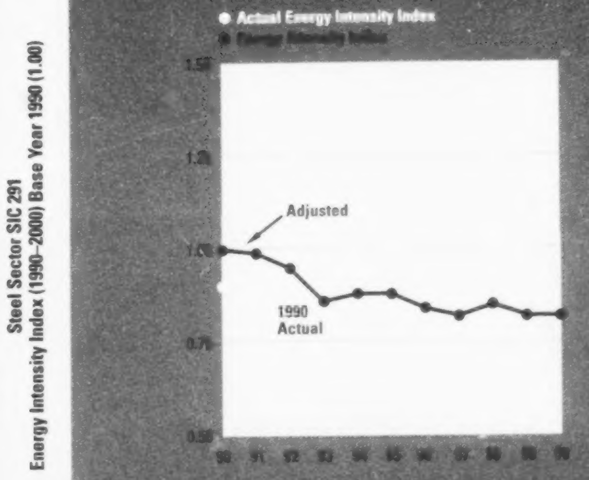
The pending deregulation of electricity in Ontario is a concern to many Canadian rubber manufacturers over the short to mid-term. Many companies fear that there will not be sufficient competition in the market to keep prices down, leading some RAC members to actively explore cogeneration to protect against higher electricity rates.

STEEL

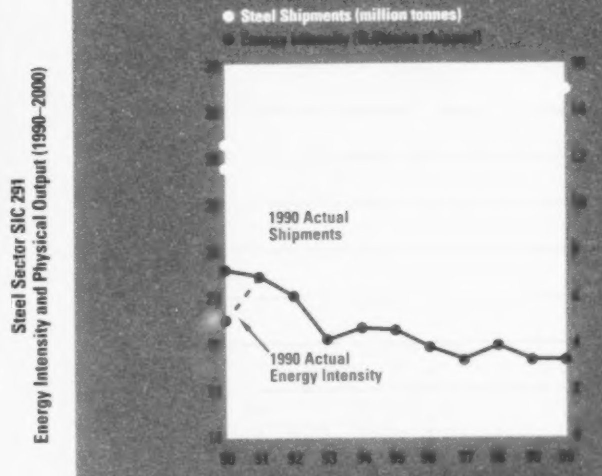
PROFILE: *Canada's steel sector is one of the country's largest industries, generating annual sales of more than $11 billion, including more than $3 billion in exports. Thirty percent of the steel produced in Canada is directly exported, and as much as 80 percent of the steel made in Canada is ultimately exported as a component of manufactured products. The industry includes 17 plants that directly employ 34 500 workers. The companies that make up the steel sector supply flat-rolled (sheet and plate), long (re-bar and structural steel) and specialty and alloy (stainless and tool steels) products for major markets in the automotive, appliance, oil and gas, machinery, construction and packaging industries. Facilities are located in five provinces, with Ontario accounting for 70 percent of Canadian steel production.*

PERFORMANCE HIGHLIGHTS

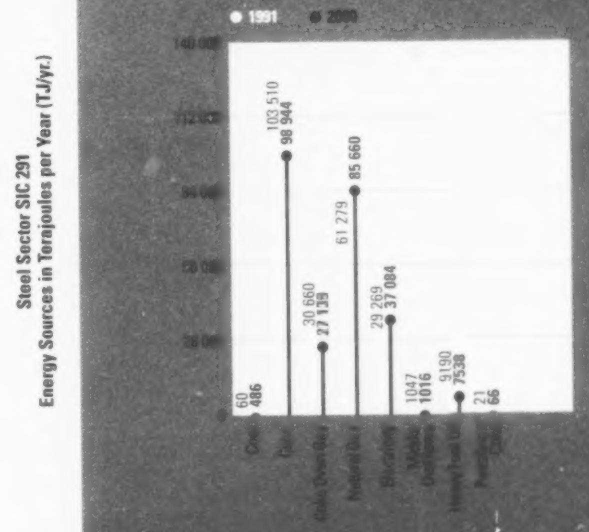
- Canada's steel industry includes 17 plants that melt and pour steel, directly employing 34 500 workers.
- Since 1990, the industry has achieved an 18-percent improvement in energy consumed per tonne shipped.
- Over the 1990–2000 period, the sector's average annual energy efficiency improvement was 1.8 percent, surpassing the industry's commitment of 1 percent per year.
- The sector's energy intensity performance improved slightly from 17.32 in 1999 to 17.29 in 2000.
- More than 90 percent of steel companies, representing more than 90 percent of production, have made commitments to voluntarily improve energy efficiency.



Data source: Statistics Canada, *Quarterly Report on Energy Supply and Demand* (QRESD), December 2001.



Data source: Statistics Canada, *Quarterly Report on Energy Supply and Demand* (QRESD), December 2001.
1990 Adjustments: Canadian Steel Producers Association



Data source: Statistics Canada, *Quarterly Report on Energy Supply and Demand* (QRESD), December 2001.

ACTIONS

Canadian steelmakers continued to invest in programs that improve energy efficiency as part of efforts to upgrade productivity and quality while reducing costs.

AltaSteel Ltd., in Edmonton, Alberta, improved combustion controls and operating practices to reduce the consumption of natural gas in its billet reheat furnace. The company established a computerized preventive maintenance program and replaced water-cooled ducting on its melting furnace with state-of-the-art equipment to reduce delays and improve reliability. Since 1991, AltaSteel has recorded an overall improvement in specific energy consumption of 8 percent.

Stelco Inc. Hilton Works, in Hamilton, Ontario, refurbished its No. 7 coke oven battery and replaced the natural gas cooling system on its E blast furnace with a nitrogen supply and top cooling system. The company introduced more efficient furnace design and improved instrumentation and control systems on its hot strip mill and plate mill reheat furnaces. These investments contributed to an overall energy efficiency improvement of 5 percent since 1989.

Dofasco Inc. of Hamilton, Ontario, introduced a steam-trap maintenance program and replaced a steam-based tar-drying system in its coke production business unit with an energy-efficient chemical treatment process. Improvements and controls introduced within the company's steelmaking business unit increased boiler fuel flexibility to displace purchased fuel with blast furnace gas in the utilities business unit. Combined, energy efficiency projects undertaken by Dofasco in 2000 translated into an annualized 0.85-percent improvement in the plant's energy rate.

Stelpipe Ltd. of Welland, Ontario, modified its Stretch Reducing Mill induction heating furnace control to reduce electricity consumption during idling periods and reduced power consumption peaks by limiting maximum electricity input. Since 1990, the company has improved its specific energy consumption by 60 percent.

Stelfil Ltée of Lachine, Quebec, replaced electroplating rectifiers and a high-voltage transformer and added electronic controls to its patenting line take-up. Since 1991, Stelfil has improved its energy efficiency by 30 percent.

Stelco-McMaster ltée of Contrecoeur, Quebec, installed a new, in-line bar mill, which reduced downtime and cut energy consumption by 14 percent. The company also increased the processing of larger-sized billets, thereby improving continuous casting productivity. Since 1989, the company has achieved a 13-percent overall improvement in specific energy consumption.

Lake Erie Steel Company of Nanticoke, Ontario, upgraded its main boiler to increase the use of blast furnace gas, thereby displacing the use of oil, coke oven gas and electricity. The company also modified its coke side emissions fan to reduce electrical consumption during idle periods and introduced a high-efficiency steel-reheating furnace in its hot strip mill. Overall, since 1990, Lake Erie Steel has improved its energy performance by 24 percent.

ACHIEVEMENTS

The Canadian steel industry produced 16.5 million tonnes of steel and shipped 14.9 million tonnes in 2000. The sector's energy intensity performance improved slightly from 17.32 in 1999 to 17.29 in 2000. Since 1990, the sector has improved its aggregated energy performance by more than 18 percent. This represents an average annual improvement of 1.84 percent, surpassing the industry's commitment to an average 1-percent-per-year improvement for the period.

The Steel Sector Task Force is confident that, between 2000 and 2010, the Canadian steel industry will improve energy intensity by an average of 1 percent per year compared with the 2000 base year. Achieving this target will enable the sector to record an equivalent improvement in energy consumption per tonne shipped of 1.6 percent per year over the 20-year period from 1990.

CHALLENGES

The Canadian steel industry is one of the most modern, high-tech industries in the world. In the last few years, the industry has created new products and opened new markets for steel. Lighter, higher-strength steels are becoming the material of choice for automakers, home builders, appliance manufacturers and others. Over the last decade, the industry has undergone a technological revolution, investing $4.7 billion in plant upgrades and new, innovative machinery. The result has been a dramatic improvement in the products the industry produces and the way in which these products are processed. Thanks to these investments, the industry's productivity growth averaged 14 percent per year through the 1990s.

However, to remain successful and retain the ability to invest in improved energy efficiency and reduced GHG emissions, Canada's steel industry must overcome two critical challenges: unfair international trade practices and an uncompetitive Canadian tax system. Unfair pricing of steel imports through dumping by subsidized foreign competitors continues to be a chronic and growing problem for North American manufacturers. Canada's position is particularly precarious because any unilateral action taken by the United States to support its domestic industry will divert foreign steel from its shores toward Canadian markets, thereby increasing the competitive pressures that Canadian producers face.

Further complicating matters for steelmakers is the Canadian corporate tax structure, which remains significantly higher than that of the United States. This places the Canadian steel industry at a competitive disadvantage with U.S. producers in North American markets and makes it challenging to generate needed capital for continued investments in energy efficiency.

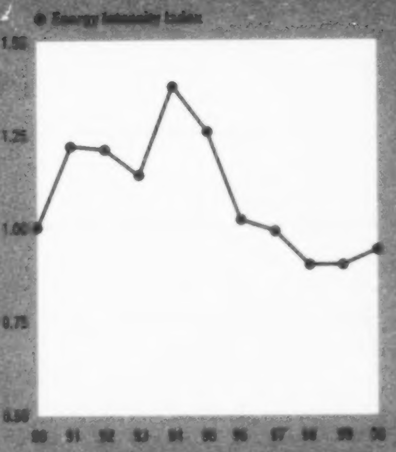
TEXTILES

PROFILE: *Canada's textiles sector produces the fibres, yarns and fabrics used in industries as diverse as automotive manufacturing, clothing, construction, environmental protection and road building. The textiles sector is organized into three subgroups: primary textiles, textiles products and motor vehicle fabric accessories. Together, the industry sells into 150 markets and exports more than 33 percent of its production.*

PERFORMANCE HIGHLIGHTS

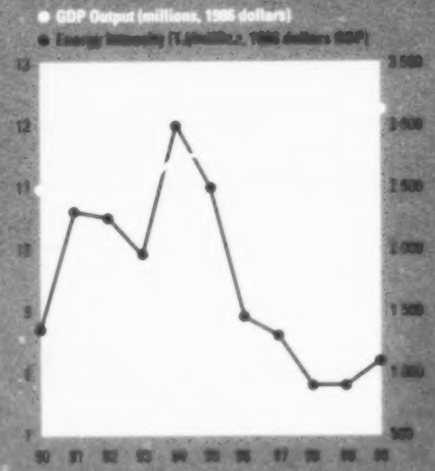
- Canada's textiles industry sells to 150 markets and exports more than 33 percent of its production.
- The sector's energy mix continues to shift from hydrocarbon sources to electricity.
- In 2000, the industry GDP output was 26 percent higher than in 1990; its energy consumption increased by 18 percent.
- St. Lawrence Corporation reduced its energy use per kilogram of product to 72 percent of 1990 levels between 1990 and 2000.
- From 1990 to 2000, Albarrie Canada Limited achieved a 28-percent reduction in energy use per unit of product.
- DuPont Canada Inc. reduced its energy intensity by almost 32 percent between 1990 and 2000.
- As a result of the industry's efforts to improve the accuracy of reporting by individual companies, Statistics Canada's 2000 data more accurately reflect the industry's actual experience.

Textiles Sector (SICs 18, 19 and 3257)
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



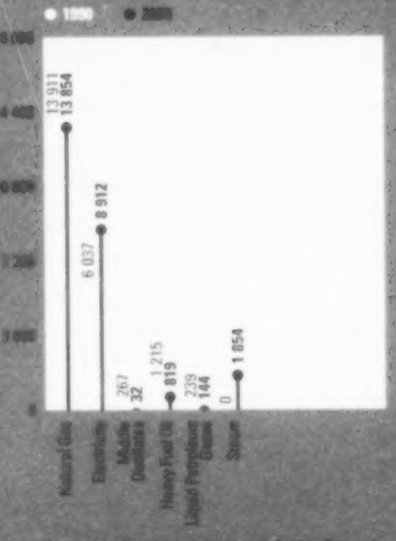
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Textiles Sector (SICs 18, 19 and 3257)
Energy Intensity and Economic Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Textiles Sector (SICs 18, 19 and 3257)
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

Throughout the textiles sector, companies are benefiting from more efficient uses of energy. J.L. De Ball Canada Inc. of Granby, Quebec, was one of the first textiles manufacturers to join the Industrial Energy Innovators Initiative and continues to actively pursue opportunities to improve energy intensity. The company has launched initiatives to improve insulation, replace windows, improve lighting, recover energy from used water and introduce more energy-efficient machinery. Although the company's energy consumption has doubled since 1990, production has increased 2.3 times. Energy use per unit of production in 1999 was 10 percent below 1990 levels.

Consoltex Inc., with headquarters in Saint-Laurent, Quebec, and four manufacturing plants in Quebec and Ontario, also identified opportunities for improved energy efficiency following audits of its facilities. Since 1995, the company has upgraded insulation and lighting and made changes to machinery and processes to cut energy costs while reducing effluent discharges and stack emissions. Consoltex is making strong progress toward a targeted 10-percent reduction in energy use per unit of production. In August 2001, Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) recognized Consoltex Inc. as a Silver Level Champion Reporter.

Albarrie Canada Limited of Barrie, Ontario, makes environmental textiles and sells them throughout the world. Strongly committed to improved energy efficiency, Albarrie has reduced energy use per unit of product by 28 percent between 1990 and 2000, well above its 1-percent-per-year energy-reduction target. In September 2001, VCR Inc. recognized Albarrie Canada Limited as a Bronze Level Champion Reporter.

St. Lawrence Corporation of Iroquois, Ontario, produces 70 000 kg per week of terry towels. An Industrial Energy Innovator since 1995, the company has made energy-saving changes in the types of fuel it uses and to its machinery and processes. It has also made special efforts to involve employees in energy efficiency activities. By the end of 2000, these efforts enabled St. Lawrence to reduce its energy use per unit of output to 72 percent of 1990 levels.

DuPont Canada Inc. completed a large performance contract to cut energy expenditures by more than $2.5 million in the adipic acid process at its plant in Maitland, Ontario. The energy-saving facilities covered by the contract began operating in the fall of 2001. This $15-million project will reduce GHG emissions by about 30 000 tonnes on a CO_2-equivalent basis per year. Overall, DuPont Canada reduced its energy intensity by almost 32 percent between 1990 and 2000.

Doubletex Inc., with facilities in Montréal, Quebec, and Toronto, Ontario, is the latest addition to the textiles sector's growing list of Industrial Energy Innovators.

In 2001, the Textiles Energy Task Force met in February, June and September. The task force continues to follow the comprehensive action plan introduced in 1997 and to focus on two principal goals: to broaden participation of textiles manufacturers in the Industrial Energy Innovators program and VCR Inc. and to strengthen the commitment of existing Industrial Energy Innovators. Manufacturers participating in the task force have agreed to demonstrate by example the economic benefits that result from effective energy efficiency programs. Moreover, task force members remain committed to follow up directly and personally with the sector's Industrial Energy Innovators to review their progress in fulfilling their commitment.

The industry continues to conduct its own survey to identify and correct inconsistencies and errors in textiles industry data currently available in government reports. More accurate information will enable the industry to better measure its success in meeting energy efficiency targets. In addition to the industry's own data-gathering activities, the Canadian Textiles Institute is providing a fifth year of financial support to the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) at Simon Fraser University.

ACHIEVEMENTS

The textiles sector's energy mix continues to shift from hydrocarbon fuels to electricity. Natural gas consumption declined from 64 percent of total energy consumption in 1990 to 54 percent in 2000. Consumption of other hydrocarbon fuels declined from 8 percent of the mix in 1990 to 4 percent in 2000; electricity's share rose from 28 percent in 1990 to 35 percent in 2000. The textiles industry's GDP output in 2000 was 26 percent higher than in 1990, and its total energy usage increased by 18 percent. As a result of the industry's efforts to improve the accuracy of reporting by individual companies, Statistics Canada's 2000 data more accurately reflect the industry's actual experience.

The Textiles Energy Task Force has committed the industry to an energy intensity target of 1 percent per year for the period 2000–2010. The sector's efforts to reach this goal will build on its energy efficiency performance improvements since 1995 and reflect ongoing consultations to meet Canada's Kyoto goals.

CHALLENGES

The task force believes that one of its key challenges is to gain the active participation of more of the industry's major producers as Industrial Energy Innovators. Task force members continue to lead in efforts to broaden this participation.

In addition to developing methods to measure energy use more accurately, increased efforts are required to sensitize those in the textiles industry to the long-term implications of Canada's Kyoto goals and to encourage active participation in Canada's new National Implementation Strategy on Climate Change. To this end, the Textiles Energy Task Force made a presentation to industry senior management at the June 2001 annual conference of the Canadian Textiles Institute.

During 2001, the Textiles Energy Task Force and the Canadian Textiles Institute have devoted significant time and resources to addressing these challenges. These organizations plan to continue and intensify their efforts.

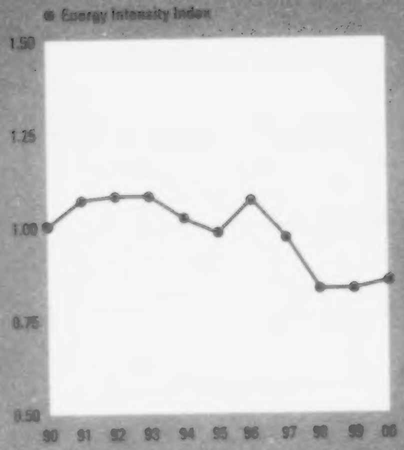
TRANSPORTATION EQUIPMENT MANUFACTURING

***PROFILE**: The Canadian transportation equipment manufacturing sector includes companies that manufacture aircraft, aircraft parts, automobiles, motor vehicle parts, trucks, buses, trailers, military vehicles, railroad rolling stock, ships and pleasure boats. The sector is a major part of the Canadian economy, accounting for nearly 3 percent of Canada's GDP and more than 15 percent of the total manufacturing GDP in 2000. Including dealers, parts and distribution networks, the sector employs more than 500 000 people across Canada.*

PERFORMANCE HIGHLIGHTS

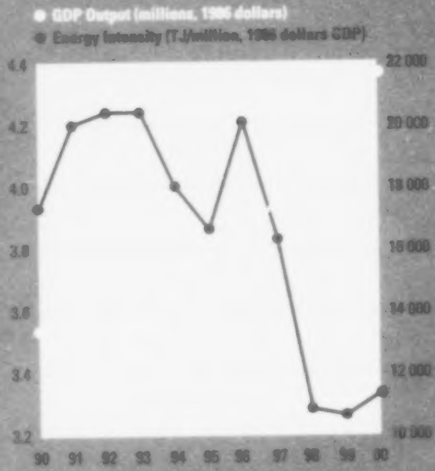
- Despite a severe downturn in the economy at the end of 2000, the value of the total output of the transportation equipment manufacturing sector for the year grew by 0.85 percent.
- Between 1990 and 2000, the sector recorded an overall improvement in energy intensity of 15 percent.
- Bombardier Inc. joined the task force in 2001, bringing aircraft industry representation.
- General Motors of Canada Limited implemented energy efficiency projects that led to annual savings of more than 3.2 million kWh of electricity.
- Ford Motor Company of Canada, Limited replaced inefficient heating systems at two assembly plants, which resulted in annual energy savings of $2 million.
- Bombardier's de Havilland Plant has reduced consumption of electricity by 2.5 percent and natural gas by 3 percent, despite a 40-percent increase in production.

Transportation Equipment Manufacturing Sector SIC 3231
Energy Intensity Index (1990–2000) Base Year 1990 (1.00)



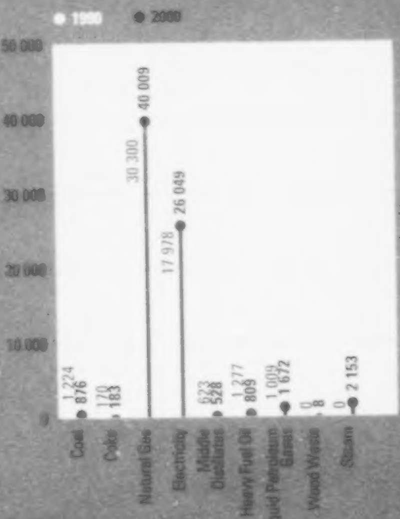
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Transportation Equipment Manufacturing Sector SIC 3231
Energy Intensity and Economic Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Transportation Equipment Manufacturing Sector SIC 3231
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

The CIPEC Transportation Equipment Manufacturing Task Force continued its tradition of promoting energy efficiency at its fifth annual "One Day Energy Conference" held at General Motors of Canada Limited headquarters in Oshawa, Ontario. Another annual energy conference is scheduled for the first quarter of 2002.

During 2001, the task force met nine times to develop an action plan, receive energy efficiency updates, review future electricity trading floors and develop conferences and outreach programs to encourage others to join. Bombardier Inc. joined the task force in 2001, bringing aircraft industry representation.

Individual sector members have made significant advances in energy efficiency. Following are examples.

General Motors of Canada Limited implemented numerous energy efficiency projects in 2000 that resulted in annual savings of more than 3.2 million kWh of electricity and 188 million gallons of water. These projects included shutting off non-productive electrical loads, improving heating and ventilation, reducing water usage and upgrading compressed-air systems. One significant project involved process modifications to enable the recirculation of humidity water in the Oshawa Truck Plant in Oshawa, Ontario, saving more than 169 million gallons of water annually.

In Oakville, Ontario, Ford Motor Company of Canada, Limited's Oakville Assembly Plant, in conjunction with the adjacent Ontario Truck Plant, replaced an inefficient steam heating system with direct-fired natural gas systems located at each main assembly building. The company estimates that this project will net energy savings of $2 million per year and result in a substantial reduction in heating system maintenance costs.

Over the past two years, Bombardier's de Havilland Plant in Downsview, Ontario, has increased production by more than 40 percent, yet reduced the consumption of electricity and natural gas by 2.5 percent and 3 percent, respectively. These reductions result from the implementation of several programs, including process optimization, revitalized energy-conservation programs, ISO 14001 initiatives and Six Sigma blitzes, which involve the modification of current operating procedures.

The Transportation Equipment Manufacturing Task Force continues to pursue the activities outlined in its 2001/2002 action plan. Specific elements of the plan include the following:

- Continue to provide leadership and promote energy efficiency among industries throughout the transportation manufacturing sector. The sector's current target is to improve its energy intensity by 1.0 percent per year for the period 2001–2005.
- Host annual energy conferences and support other workshops and forums that are beneficial to the sector.
- Recruit new companies and associations in the sector to the task force.
- Actively encourage companies to submit action plans to Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.) and the Industrial Energy Innovators Initiative.
- Promote the Energy Resource Management System (ERMS) program in the automotive parts sub-sector and encourage its expansion for use in other sectors.

ACHIEVEMENTS

Although 2000 ended with a severe downturn in the economy, the value of the total output of the transportation equipment manufacturing sector for the year still grew by 0.85 percent, due mainly to continued expansion in the automotive parts industry. Energy usage for the year increased by 4.76 percent over 1999, a rate considerably higher than output growth. Consequently, energy intensity increased by 2.2 percent. In 2000, the sector consumed 72 290 TJ of energy, up 37.5 percent from 1990. Over the same period, gross output increased by 71 percent, leading to an overall improvement in energy intensity of 15 percent.

Energy use by fuel type has remained fairly constant since 1990, with natural gas (55 percent) and electricity (36 percent) making up the bulk of the energy used. Liquid petroleum gases, middle distillates (No. 2 fuel oil), heavy fuel oil and coal use have reversed a steady decline and increased 14.5 percent in 2000, due largely to the rapid escalation of natural gas prices. The use of these fuels will undoubtedly continue to increase until natural gas prices return to former levels.

CHALLENGES

The downturn in the economy, especially in the automotive sector, has had a detrimental effect on energy intensity. Despite suddenly higher natural gas costs, economically motivated plant downtime has led to the under-utilization of facilities, thereby causing energy intensity numbers to soar, despite an overall decrease in energy usage. Although the transportation equipment manufacturing sector is committed to continuously improving quality, environmental performance and energy efficiency, investment-payback requirements of less than two years and internal competition for funds are challenging energy managers who are seeking to make major gains. Moreover, energy efficiency improvements arising from the implementation of new technology are likely to be offset by trends that are driving energy use higher. These trends include the increased use of cooling to improve working conditions, more demanding pollution control and a shift to more energy intensive products and processes.

Between 1990 and 2000, GHG emissions increased by 35 percent, despite the sector's best efforts. It is improbable that the sector will meet a sector-specific target that parallels Canada's Kyoto goal to reduce overall emissions by 6 percent below 1990 levels. Sector companies are already efficient energy users, and there are relatively few cost-effective opportunities for dramatic gains, even with high energy costs. Unless there are major advances in technology, energy efficiency improvements are likely to come in small increments.

UPSTREAM OIL AND GAS

***PROFILE**: The upstream oil and gas sector includes the companies that find and develop Canada's vast hydrocarbon reserves. This dynamic oil and natural gas exploration and production industry is represented by the Canadian Association of Petroleum Producers (CAPP) and the Small Explorers and Producers Association of Canada (SEPAC). The member companies of these associations account for more than 99 percent of the crude oil and natural gas produced in Canada. The industry is a major economic force, with one of every 30 jobs in Canada directly or indirectly tied to the oil and natural gas sector.*

PERFORMANCE HIGHLIGHTS

- The Canadian Association of Petroleum Producers' (CAPP's) 150 member companies account for more than 97 percent of the crude oil and natural gas produced in Canada.
- CAPP's Stewardship initiative encourages members to continually improve their environmental, health and safety performance.
- A province-wide effort in Alberta by CAPP members led to a reduction in flaring of 38 percent below 1996 levels by the end of 2000.
- Conoco Canada reduced its emissions by approximately 65 000 tonnes of CO_2 equivalent per year in 2000.
- In 2000, Chevron Canada Resources reduced its flare gas volumes by 6 percent and recorded an impressive solution gas conservation rate of 99.7 percent.
- Actions taken by ExxonMobil Canada have reduced its production carbon intensity by 5 percent over four years.
- Richland Petroleum Corporation now captures previously flared solution gas and diverts it for use as fuel for pumpjacks and lineheaters.
- Pioneer Natural Resources Canada Inc. reduced its energy consumption by 43 percent over 10 years.
- BP Canada Energy Company has begun retrofitting its compressor engines with more energy-efficient air-fuel ratio controllers.

The sector is currently working with the Office of Energy Efficiency of Natural Resources Canada to develop indices and figures.

ACTIONS

The upstream oil and gas sector is a strong proponent of environmental performance and energy conservation. In 1999, CAPP established its Stewardship initiative, a voluntary program that encourages members to continually improve their environmental, health and safety performance and to report their progress to stakeholders.

The industry is also a key participant in the Clean Air Strategic Alliance (CASA), a multi-stakeholder group that includes regulators, non-governmental organizations and industry, established to develop strategies to improve Alberta's air quality. In 1998, CASA developed a framework for managing the reduction of natural gas flaring in Alberta. Accordingly, by the end of 2000, operators reduced flaring in Alberta by 38 percent below 1996 levels, surpassing 2001 targets.

The industry is now working with CASA to develop a management framework to deal with vented emissions in the province. Venting happens when individual wells release small amounts of methane directly to the atmosphere. The total of such emissions increased significantly from 1999 to 2000, largely due to improved reporting and increased heavy oil production.

In recent submissions to Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.), 28 CAPP member companies reported more than 300 emissions-reduction projects undertaken between 1999 and 2001 and planned for 2002. These projects included reductions in the use of fuel and electricity, lowered methane releases and improved process efficiencies. Total emissions reductions from conventional oil and gas operations tallied in these reports were 6.7 megatonnes of CO_2 equivalent, while oil sands reported reductions of 6.3 megatonnes of CO_2 equivalent.

Individual petroleum producers have made significant strides toward improved energy efficiency and reduced GHG emissions. Following are examples.

Conoco Canada reported that GHG-reduction projects implemented in 2000 and 2001 cut its emissions by approximately 65 000 tonnes of CO_2 equivalent per year, with a further reduction of 112 000 tonnes planned for 2002. Combined, these reductions represent a total decrease in GHG emissions of 7.4 percent.

Chevron Canada Resources has implemented a software database that provides the company with a corporate-wide structure for reporting energy consumption and GHG emissions estimates. In 2000, Chevron reduced its flare gas volumes by 6 percent and recorded an impressive solution gas conservation rate of 99.7 percent.

ExxonMobil Canada achieved its 1997 goal by reducing its production carbon intensity by 5 percent over four years. These actions reduced the company's overall CO_2-equivalent emissions by a total of 1.14 kilotonnes per year. The company has now set its target at a further reduction of 2 percent per year.

Richland Petroleum Corporation captures previously flared solution gas for use as fuel for pumpjacks and lineheaters. The company converts pneumatic instrumentation in order to use air instead of natural gas. Richland has also installed vapour recovery units to reduce methane and volatile organic compounds emissions.

Since 1990, Pioneer Natural Resources Canada Inc. has reduced its energy consumption from 2 170 179 GJ to 1 239 400 GJ per year, a 43-percent improvement. Due to the combination of large and small energy efficiency actions over the same period, the company has reduced its CO_2-equivalent emissions by 39 percent.

BP Canada Energy Company has begun retrofitting "rich burn" turbocharged compressor engines in its natural gas operations with REMVue™ air-fuel ratio controllers, which reduce the amount of fuel needed to produce the same amount of work ~~energy.~~ These controls reduce fuel consumption by an average of 15 percent, thereby cutting CO_2 emissions by 10 percent, NO_x by 50 percent and CO by 90 percent.

Talisman Energy Inc. now scrutinizes equipment purchases to ensure that new devices meet energy efficiency standards. The company also designs its field systems to eliminate unnecessary energy drains and is improving energy tracking by installing new energy data management software.

ACHIEVEMENTS

The upstream oil and gas sector is a recent addition to the CIPEC family. As part of its commitment to CIPEC, the sector has implemented a common energy reporting system. This enables a meaningful and consistent gathering of energy use and carbon intensity data. The sector has piloted and conducted a number of energy workshops and has conducted a number of "Dollars to $ense" workshops in 2001, including the "Monitoring and Tracking" and "Energy Master Plan" workshops.

Under the leadership of CAPP and SEPAC, the sector is firmly committed to sound environmental principles and will intensify its focus on energy efficiency. Member companies have already made significant strides in this direction and are continuing to take individual actions that, when combined, make a significant contribution to Canada's efforts to improve its competitiveness while working to meet its international climate change goals.

CHALLENGES

Rising energy demands and higher prices have driven the rapid increase in exploration and development. Greater activity in the field translates into more energy consumption. This makes a reduction of overall energy use within the sector unlikely in the short term. However, sector companies have made substantial progress in reducing their energy intensity and, subsequently, their carbon intensity. With the introduction of a standardized energy-reporting format in 2001, the sector has begun to build a meaningful base of energy data in order to measure its progress in the years ahead.

Petroleum exploration, development and processing companies are aware of the economic and environmental benefits of improved energy efficiency and are committed to continuing to implement measures that reduce waste and improve energy intensity.

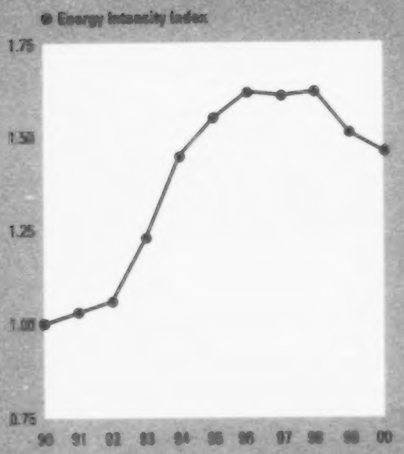
WOOD PRODUCTS

PROFILE: *The wood products sector includes sawmills, planing mills and shingle mills that manufacture products that range from timber to finished lumber for domestic and world markets. At the end of 2000, the industry consisted of nearly 3000 establishments across Canada that employed just under 20 000 workers.*

PERFORMANCE HIGHLIGHTS

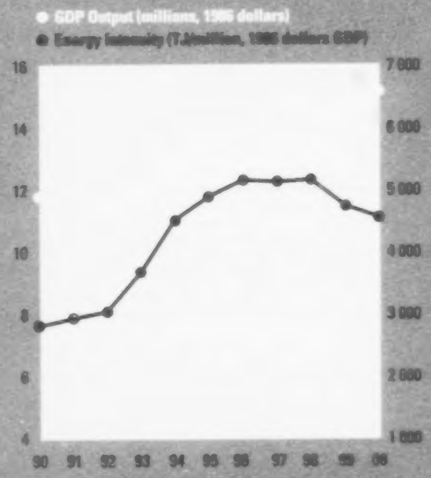
- In 2001, Weldwood of Canada lowered its GHG emissions to 1990 levels by reducing fossil fuel consumption and substituting energy from forest by-products.
- Domtar Inc. modernized five small log sawlines in Quebec and Ontario by installing equipment that is more efficient.
- Canfor Corporation is studying cogeneration projects that could offset emissions of 107 000 tonnes of CO_2 equivalent per year.
- Erie Flooring and Wood Products and Madawaska Doors Inc. have signed on as Industrial Energy Innovators.
- Wood products companies continue to develop cost-effective biomass energy systems to replace systems that use costly natural gas and electricity.

Wood Products Sector SIC 25
Energy Intensity Index



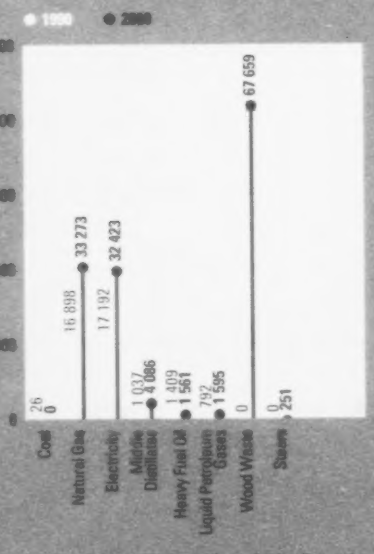
Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Wood Products Sector SIC 25
Energy Intensity and Economic Output (1990–2000)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

Wood Products Sector SIC 25
Energy Sources in Terajoules per Year (TJ/yr.)



Data source: Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC), *Development of Energy Intensity Indicators for Canadian Industry: 1990–2000*, January 17, 2002, Simon Fraser University.

ACTIONS

Forest product companies are actively building energy efficiency through capital investment and the improvement of operating methods. For example, Weldwood of Canada Limited uses innovative technologies in all of its operations to support its strong commitment to the environment. Weldwood's wood products facilities maximize wood use, diverting wood residues to fabricate new products such as fibreboard and finger-jointed lumber or to produce energy. Over the past decade, Weldwood has achieved significant success in reducing GHG emissions despite increasing its overall production. In 2001, the company met its goal of lowering GHG emissions to 1990 levels by reducing fossil fuel consumption and substituting energy from forest by-products, such as wood shavings, which are used as fuel.

Domtar Inc.'s wood products group has modernized five small log sawlines in Quebec and Ontario with more efficient equipment using variable frequency electrical drives. The installations improved fibre yields as well as energy consumption efficiency. In a joint partnership with Anthony Forest Products Co. of Eldorado, Arkansas (Anthony-Domtar Inc.), Domtar built and commissioned a state-of-the-art plant to manufacture engineered wood I-joists in Sault Ste. Marie, Ontario. The company has several other projects underway that will help to improve Domtar's overall energy efficiency.

Canfor Corporation, based in Vancouver, British Columbia, is considering projects at its Fort St. James and Chetwynd sawmills that will directly reduce GHG emissions by substituting wood-residue-derived heat for natural gas in mill lumber-drying kilns. Collectively, these projects could offset approximately 26 000 tonnes carbon dioxide equivalent (CO_2e) of GHG emissions. Canfor is also studying cogeneration projects that could offset as much as 2208 TJ of natural gas, or approximately 107 000 tonnes of CO_2 equivalent.

In Alberta, Canfor will supply 112 000 bone dry tonnes (Bdt) of mill residues to a planned 25-MW cogeneration facility located at the company's Grande Prairie sawmill site. In addition to the "green" electricity produced, the project will supply more than 200 000 GJ of heat to offset natural gas consumed by lumber-drying kilns, directly reduce Canfor's GHG emissions by approximately 11 000 tonnes CO_2e, and offset a further 22 000 tonnes by reducing its electricity consumption from the Alberta grid. In 2000, GHG emissions per unit of production at Canfor's sawmills were 82.7 tonnes CO_2e per thousand board feet (Mfbm), a decrease of 10.2 percent from the 1990 level of 92.1 tonnes CO_2e/Mfbm.

As part of energy awareness initiatives begun in 2001, Erie Flooring and Wood Products of West Lorne, Ontario, and Madawaska Doors Inc. of Barrie, Ontario, signed on as Industrial Energy Innovators. The companies received an audit incentive from Natural Resources Canada to identify energy efficiency opportunities that their respective plants can implement to lower energy use, cut production costs and demonstrate support for Canada's GHG-reduction goals.

In 2001, Forintek Canada Corp. launched an energy-benchmarking project that will support the CIPEC Wood Products Sector Task Force's efforts to promote energy efficiency in the solid wood industry. Forintek will study industry performance in Canada and abroad to develop the benchmarking data needed to establish energy efficiency targets, action plans and policies within the sector's companies.

ACHIEVEMENTS

The wood products sector consumed 73 192 TJ of fossil fuels and electricity in 2000. Strong demand for the industry's products has increased the sector's production by 50 percent over the last decade. In turn, this has led to a rise in the total energy consumed by the sector over the same period. Due to measures taken to improve energy efficiency, energy intensity has improved over the last five years.

The impact on production costs brought by fluctuating energy prices provides an additional incentive for wood products companies to identify and implement low-cost energy efficiency measures. Companies continue to develop cost-effective biomass energy systems to displace the use of costly natural gas and electricity. However, ongoing adverse economic factors continue to impair the sector's energy efficiency efforts and are forcing companies to develop new, higher-value products and to pursue new markets. These efforts often lead to the production of goods that require higher rates of energy consumption.

CHALLENGES

Companies in the wood products sector have continued to make investments and introduce measures that improve energy efficiency. However, the ability to make such investments depends directly on the strength of the sector's markets and favourable pricing both at home and abroad. Unfortunately, actions taken against the importation of Canadian softwood lumber by the United States has had a serious impact on the Canadian forest products industry. These actions have impaired the flow of Canadian lumber into the U.S. market, thereby creating a glut of product in the domestic market. In turn, this glut has reduced Canadian lumber prices to their lowest levels in years.

Canadian companies have responded by closing facilities and allocating production to fewer mills in an attempt to maintain production efficiency at sustainable levels. However, weak prices and shrinking markets have combined to make it exceedingly difficult for most forest products companies to make investments in energy efficiency. While the closure of facilities will reduce the sector's total energy consumption over the short term, the lack of investments in energy efficiency make it unlikely that the industry will be able to make significant improvements in energy intensity.

INDUSTRIAL ENERGY INNOVATORS BY SECTOR

Through Natural Resources Canada's Office of Energy Efficiency (OEE), the Industrial Energy Innovators program focuses on transforming the sector-level commitments made by the task forces into company-level action by helping to overcome obstacles to energy efficiency at the company level.

As of April 1, 2002, 314 manufacturing and mining companies – representing approximately 85 percent of industrial energy use in Canada – have signed on as Industrial Energy Innovators. The majority of these companies are participants in VCR Inc.

For information on becoming an Industrial Energy Innovator, contact the OEE by e-mail at cipec.peeic@nrcan.gc.ca or visit the Web site at http://oee.nrcan.gc.ca/cipec.

INDUSTRIAL ENERGY INNOVATORS

Aluminum

Alcan Inc.
Alcoa – Aluminerie de Baie-Comeau
Alcoa – Aluminerie de Bécancour inc.
Alcoa – Aluminerie Lauralco inc.
Aluminerie Alouette inc.

Cement

Blue Circle Cement
ESSROC Canada Inc.
Inland Cement Limited
Lafarge Canada Inc.
St. Lawrence Cement Inc.
Tilbury Cement Ltd.

Chemicals

Chinook Group Limited – Sombra Plant
Degussa-Huls Canada Inc.
DuPont Canada Inc.
Elementis Pigments Canada
MDS Nordion Inc.
Nacan Products Limited
NOVA Chemicals Corporation
OxyVinyls Canada Inc.
PolyOne Canada Inc.
Rohm and Haas Canada Inc.

Electrical/Electronics

ASCOlectric Ltd.
Broan-NuTone Canada
Camco Inc.
Century Circuits Inc.
Honeywell Limited
IBM Canada Ltd.
Nortel (Northern Telecom Limited)
Osram Sylvania Ltd.
Vansco Electronics Ltd.

Electricity Generation

Ontario Power Generation Inc.

Food and Beverage

Alberta Processing Co., A Division of
West Coast Reduction Ltd.
Andrés Wines Ltd.
API Grain Processors
Armstrong Cheese Company Ltd. – Alberta
Better Beef Ltd.
Big Rock Brewery Ltd.
Black Velvet Distilling Co.
Borden Foods Canada
Burnbrae Farms Ltd. – Mississauga
Canada West Foods J.V. Inc.
Canamera Foods
Canbra Foods Ltd.
Canyon Creek Soup Company Ltd.
Cargill Animal Nutrition – Camrose Plant
Cargill Animal Nutrition – Lethbridge Plant
Carson Foods
Casco Inc.
Champion Petfoods
Coca-Cola Bottling Ltd.
Cuddy Food Products
Family Muffins & Desserts Inc.
Foothills Creamery
Garden Province Meats Inc.
H.J. Heinz Company of Canada Ltd.
Heritage Frozen Foods Ltd.
Hubberts Industries
Hub Meat Packers Ltd. – Sunrise Brand
Kraft Canada Inc.
Labatt Breweries of Canada
Legal Alfalfa Products Ltd.
Lilydale Cooperative Ltd.
Lone Pine Cheese Ltd.
Maple Leaf Consumer Foods
Maple Leaf Pork – Alberta
Maple Leaf Pork – Ontario
Maple Lodge Farms Ltd.
Marsan Foods Limited
McCain Foods (Canada) – Alberta,
A Division of McCain Foods Limited
Molson Breweries – Edmonton Brewery
Molson Canada – Ontario
Moosehead Breweries Ltd.
Nestlé Canada Inc.
Northern Alberta Processing Co.,
A Division of West Coast Reduction Ltd.
Oakrun Farm Bakery Ltd.
Olymel, L.P.
Parmalat Canada Ltd. – Alberta
Parmalat Dairy and Bakery Inc.
Pepsi-Cola Canada Beverages
Pine River Cheese and Butter Co-operative
Prairie Mushrooms (1992) Ltd.
Principality Foods Ltd.
Quality Fast Foods
Sakai Spice (Canada) Corporation
Schneider Foods
Sleeman Brewing and Malting Co. Ltd.
Sunrise Bakery Ltd.
Sun-Rype Products Ltd.
Sun Valley Foods Canada
Transfeeder Inc.
Trochu Meat Processors
Unifeed Premix
Versacold Corporation
Westcan Malting Ltd.
Westglen Milling Ltd.
Weston Foods Inc.

Foundry

Ancast Industries Ltd.
Bibby-Ste-Croix
Crowe Foundry Limited
ESCO Limited – Port Hope Operations
Eureka Foundry Corporation (A Subsidiary of
ACI Canada Inc.)
Gamma Foundries Limited
Grenville Castings Limited
Ramsden Industries Limited
Vehcom Manufacturing (A Division of
Comtech Mfg. Ltd.)
Wabi Iron & Steel Corporation

General Manufacturing

3M Canada Inc.
ABCO Property Management Inc.
Bentofix Technologies Inc.
Canadian Uniform Limited
Champion Feed Services Ltd.
Coyle & Greer Awards Canada Ltd.
Crown Cork & Seal Canada Inc.
EMCO Limited – Building Products
Envirogard Products Ltd.
Escalator Handrail Company Inc.
Euclid-Hitachi Heavy Equipment Ltd.
Federated Co-operatives Limited
Ferraz Shawmut Canada Inc.
Fibrex Insulations, Inc.
Garland Commercial Ranges Limited
Greif Containers Inc.
Imperial Home Decor Group Canada Inc.
Imperial Tobacco Limited
Interface Flooring Systems (Canada) Ltd.
International Paper Industries Ltd.
Jones Packaging Inc.
Kindred Industries
Kodak Canada Inc.
LePage (Division of Henkel Canada Limited)
Madawaska Doors Inc.
Maksteel Service Centre (Division of Makagon
Industries Ltd.)
Metroland Printing, Publishing & Distributing Ltd.
Owens Corning Canada Inc. – Toronto Plant
Polytainers Inc.
PRO-ECO Limited
S.C. Johnson and Son, Limited
Sandvik Tamrock Canada Inc.
Sandvik Tamrock Loaders Inc.
Scapa Tapes North America
Simmons Canada Inc.
Soprema Inc. (Drummondville Plant)
Superior Radiant Products Ltd.
Teknion Furniture Systems Inc.
VicWest Steel
Wabash Alloys Ontario
Wyeth-Ayerst Canada Inc.

Lime
Beachville Lime Limited
Chemical Lime Company of Canada Inc.
Dundas Lime Limited
Graymont (NB) Inc.
Graymont (QC) Inc.
Graymont Western Canada Inc.
Northern Lime Limited

Mining
Aur Resources Inc.
Barrick Gold Corporation – La Mine Doyon
(Division of Cambior Inc.)
BHP Billiton Diamonds Inc.
Boliden Limited
Canadian Electrolytic Zinc Limited
Echo Bay Mines Ltd. – Lupin Operation
Falconbridge Limited
Fonderie Horne – Métallurgie Noranda inc.
Hillsborough Resources Limited
Hudson Bay Mining & Smelting Co., Ltd.
Inco Limited
International Minerals and Chemicals (Canada)
Global Limited (IMC Kalium Canada Ltd.)
Iron Ore Company of Canada
Mines et exploration Noranda inc. –
Division Matagami
Mines Wabush (Managed by
Compagnie Minière Cliffs inc.)
Newmont Canada Limited, Golden Giant Mine
Noranda Inc. – Brunswick Mining Division
Noranda Inc. – Brunswick Smelter
Noranda Metallurgy Inc. (Canadian Copper Refinery)
Placer Dome Canada Limited
Quebec Cartier Mining Company
Syncrude Canada Ltd.
Teck Cominco Limited

Petroleum Products
Canadian Tire Petroleum
Chevron Canada Limited – Burnaby Refinery
Enbridge Pipelines Inc.
Husky Energy Inc.
Imperial Oil Limited
Irving Oil Limited
Parkland Refining Ltd.
Petro-Canada
Safety-Kleen Corp.
Shell Canada Products Limited
Suncor Energy Inc. – Sunoco Group
Ultramar Ltd. (Saint-Romuald Refinery)

Plastics
Downeast Plastics Ltd.
Husky Injection Molding Systems Ltd.
The Clorox Company of Canada, Ltd.
Par-Pak Ltd.

Potash
Potash Corporation of Saskatchewan Inc.
– Allan Division
– Cory Division
– Lanigan Division
– New Brunswick Division
– Patience Lake Division
– Rocanville Division

Pulp and Paper/Forestry
Abitibi-Consolidated Inc.
Bowater Canadian Forest Products Inc.
Canfor Corporation
Cariboo Pulp and Paper Company Limited
Cascades Inc.
Domtar Inc.
Emballages Smurfit-Stone Canada inc. –
La Tuque Plant
Erie Flooring and Wood Products
Eurocan Pulp & Paper Company Limited
F.F. Soucy Inc.
Kruger Inc.
Lake Utopia Paper
Marathon Pulp Inc.
Marcel Lauzon Inc.
Maritime Paper Products Limited
Nexfor Inc.
Norampac Inc. (Division of Cascades Inc.)
NorskeCanada
Paperboard Industries International Inc.
(Division of Cascades Inc.)
Papiers Stadacona
Perkins Papers Inc. (Division of Cascades Inc.)
Riverside Forest Products Limited, Armstrong Division
Rolland Inc. (Division of Cascades Inc.)
St. Marys Paper Ltd.
Stora Enso North America, Port Hawkesbury Mill
Stowe Woodward Co. (British Columbia)
(Division of Cascades Inc.)
Tembec Inc.
Tembec Paper Group – Spruce Falls Operations
Tolko Manitoba Kraft Papers
UPM-Kymmene Corporation
Weldwood of Canada Limited
West Fraser Timber Co. Ltd.
Weyerhaeuser Canada Ltd.

Rubber
Michelin North America (Canada) Inc.
NRI Industries Inc.

Steel
Algoma Steel Inc.
AltaSteel Ltd.
Atlas Specialty Steels (A Division of
Slater Stainless Corp.)
CHT Steel Company Inc.
Co-Steel LASCO
Dofasco Inc.
Gerdau Courtice Steel Inc.
Hilton Works (A Division of Stelco Inc.)
Ivaco Inc. (Ivaco Rolling Mills)
Lake Erie Steel Company (A Division of Stelco Inc.)
Laurel Steel (Division of Harris Steel Limited)
QIT – Fer et Titane inc.
Slater Steel Inc. – Hamilton Specialty Bar Division
Stelco inc.
Stelco-McMaster ltée
Stelfil Ltée
Stelpipe Ltd.
Stelwire Ltd.
Sydney Steel Corporation
Welland Pipe Ltd.

Textiles
Agmont Inc.
Albarrie Canada Limited
Barrday Inc.
Beaulieu Canada Inc.
Bennett Fleet (Quebec) Inc.
Britex Group (The)
C.S. Brooks Canada Inc. (Magog)
Cambridge Towel Corporation (The)
Cavalier Textiles
Coats and Clark Canada
Coats Bell
Collingwood Fabrics Inc.
Collins & Aikman Canada Inc.
Consoltex Inc.
CookshireTex inc.
Denim Swift
Doubletex Inc.
Fabrene Inc.
J.L. De Ball Canada Inc.
LaGran Canada Inc.
Lincoln Fabrics Ltd.
Manoir Inc.
Monterey Textiles (1996) Inc.
Nova Scotia Textiles, Limited
PGI-DIFCO Performance Fabrics Inc.
Spinrite Inc.
St. Lawrence Corporation
Stedfast Inc.
Velcro Canada Inc.
VOA Colfab Inc.

Transportation Equipment Manufacturing
Accuride Canada Inc.
Air Canada Technical Services
Boeing Toronto Limited
Bombardier Inc. – Valcourt Plant
Cami Automotive Inc.
Canadian General-Tower Limited
DaimlerChrysler Canada Inc.
Dresden Industrial, A Division of
KSR International Co.
Dura Automotive Systems (Canada), Ltd.
Ford Motor Company of Canada, Limited
General Motors of Canada Limited
Honda of Canada Mfg.
International Truck and Engine Corporation Canada
Oetiker Limited
Orenda Aerospace Corporation
Orion Bus Industries Inc.
Oxford Automotive, Inc. –
Suspension Division, Chatham
Polywheels Manufacturing Ltd.
Pratt & Whitney Canada Inc.
Presstran Industries
Prevost Car Inc.
Rockwell Automation Canada Inc.
Russel Metals Inc.
Sterling Trucks, A Division of Freightliner Limited
Toyota Motor Manufacturing Canada Inc.
TRW Automotive
Volvo Cars of Canada Ltd.
Woodbridge Group (The)

Upstream Oil and Gas
BP Canada Energy Company
Nexen Inc.
Paramount Resources Ltd.

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Forintek Canada Corporation

Mining Association of Canada

Ontario Food Producers' Association

Packaging Association of Canada

Quebec Forest Industries Association

Small Explorers and Producers Association of Canada

The Rubber Association of Canada

GLOSSARY OF TERMS

Annual Census of Mines

NRCan survey that collects information on SIC 06 and SIC 08.

Annual Survey of Manufacturers (ASM)

Statistics Canada survey. Provides information on the consumption of purchased fuels and electricity (CPFE) for approximately 230 subsectors at four-digit SIC code levels.

Base Year

A reference year. For the Framework Convention on Climate Change, 1990 is the base year.

Canada's Climate Change Voluntary Challenge and Registry Inc. (VCR Inc.)

VCR Inc. is a key element of Canada's National Action Program on Climate Change. It encourages the private and public sectors to take voluntary steps to limit or reduce GHG emissions. As a first step, participants are encouraged to submit a letter of intent confirming a commitment to limit or reduce GHGs from their operations. This is followed by an action plan and subsequent progress reports. The Industrial Energy Innovators program provides a means for manufacturing and mining companies to enrol in VCR Inc.

Carbon Dioxide (CO$_2$)

A compound of carbon and oxygen that in its normal gaseous state is clear and colourless. CO$_2$ is formed whenever carbon-bearing fuels are burned. It can also be formed via other reactions not involving combustion.

Economic Energy Intensity

Energy consumption per unit of economic output.

Embodied Energy

The energy consumed to transform all upstream raw materials into the final product; in a life cycle approach, it would be the "cradle to grave" energy burden.

Energy Intensity

Energy consumption per unit of output.

Energy Intensity Indicator

A dimensionless ratio equal to the energy intensity in a particular year divided by the energy intensity of the base year. The energy intensity indicator for the base year equals 1.0.

Energy Performance Measures

Any of a variety of metrics that would indicate an aspect of energy performance.

Framework Convention on Climate Change (FCCC)

United Nations convention to address climate change signed by more than 150 countries at the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992. Canada became the eighth country to ratify the Convention, which entered into force on March 21, 1994, thereby committing to work toward stabilizing GHG emissions at 1990 levels by the year 2000.

Greenhouse Gas (GHG)

A GHG absorbs and radiates heat in the lower atmosphere that otherwise would be lost in space. The greenhouse effect is essential for life on this planet since it keeps average global temperatures high enough to support plant and animal growth. The main GHGs are carbon dioxide (CO$_2$), methane (CH$_4$), chlorofluorocarbons (CFCs) and nitrous oxides (N$_2$O). By far the most abundant GHG is CO$_2$, accounting for 70 percent of the greenhouse effect.

Gross Domestic Product (GDP)

The total value of goods and services produced by the nation's economy before deduction of depreciation charges and other allowances for capital consumption, labour and property located in Canada. It includes the total output of goods and services by private consumers and government, gross private domestic capital investment and net foreign trade. GDP figures are reported in real 1986 dollars.

Higher Heating Value

The amount of heat that is obtained when a specified amount of fuel is combusted with its stoichiometrically correct amount of air, both being at 15°C when combustion starts, and the products of combustion being cooled to 15°C before the heat release is measured (also called gross calorific value or gross heating value).

Industrial Consumption of Energy (ICE) Survey

Statistics Canada survey on energy use. Covers purchased and non-purchased energy for approximately 24 industrial subsectors.

Lower Heating Value

The higher heating value minus the latent heat of vaporization of the water vapour formed by the combustion of any hydrogen present in the fuel. For a fuel with no hydrogen, the higher and lower heating values are the same (also called the lower calorific value or the net heating value).

Natural Resources Canada (NRCan)

The predominant natural resources department of the Government of Canada. NRCan has a mandate to promote the sustainable development and responsible use of Canada's mineral, energy and forestry resources and to develop an understanding of Canada's land mass.

Nitrogen Dioxide (NO$_2$)

One of a group of gases called nitrogen oxides, which are composed of nitrogen and oxygen. Like sulphur dioxide, nitrogen oxides can react with other chemicals in the atmosphere in the presence of sunlight to form acidic pollutants, including nitric acid.

Nitrogen Oxides (NO$_x$)

The sum of nitric oxide (NO) and nitrogen dioxide (NO$_2$). Nitrogen oxides react with volatile organic compounds in the presence of sunlight to form ground-level ozone.

Physical Energy Intensity

Energy consumption per unit of physical output.

Quarterly Report on Energy Supply and Demand (QRESD)

Provides an energy balance of all energy consumption in Canada. QRESD data on the manufacturing industries are gathered principally by the Industrial Consumption of Energy (ICE) survey. These data are supplemented by other surveys on the disposition of energy (from utilities) and the production of petroleum products.

Specific Energy (Consumption)

Energy consumption per physical unit of output (also called physical energy intensity).

Standard Industrial Classification (SIC)

Statistics Canada uses a classification system that categorizes establishments into groups with similar economic activities.

Statistics Canada

Statistics Canada is the country's national statistical agency, with programs organized into three broad subject areas: demographic and social, socio-economic and economic. Under the *Statistics Act*, Statistics Canada is required to collect, compile, analyse, abstract and publish statistical information on virtually every aspect of the nation's society and economy. All information given to Statistics Canada through surveys, the census or any other source is confidential. Statistics Canada does not release any information that identifies an individual or organization.

Tier I

Informal designation by CIPEC of industries that are major energy-consuming industries. The seven designated Tier I industries are pulp and paper, petroleum refining, cement, mining, steel, chemicals and aluminum. The Tier I industries account for approximately 80 percent of total Canadian industrial energy consumption.

Tier II

Informal designation by CIPEC of industries that are minor energy-consuming industries (relative to Tier I industries) but contribute substantially to Canadian industrial GDP. Tier II industries account for 60 percent of Canadian industrial GDP.

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The Office of Energy Efficiency of Natural Resources Canada
strengthens and expands Canada's commitment to energy efficiency
in order to help address the challenges of climate change.

Leading Canadians to Energy Efficiency at Home, at Work and on the Road

Canada